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Development and Growth in Northeast India

The Natural Resources, Water, and Environment Nexus

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Acronyms and abbreviations

CDM	Clean Development Mechanism
CFANE	Community Forestry Alliance for Northeast India
CFM	community forest management
GEF	Global Environment Facility
IFAD	International Fund for Agricultural Development
IWAI	Inland Waterways Authority of India
JFM	Joint Forest Management
MoDONER	Ministry of Development of North Eastern Region
NW-2	National Waterway 2

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Vice President	-	Praful Patel
Country Director, India	-	Isabel M. Guerrero
Sr. Country Manager, India	-	Fayez S. Omar
Sector Director	-	Constance Bernard
Task Leader	-	Karin Kemper

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Executive summary

I. Introduction

1. India's Northeastern Region consists of eight states – Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura – occupying 262,179 square kilometers and with a population of 39 million (2001 census). Most accounts and discussions about the Northeast point out its diversity in people, plants, and animal life. The region is rich in natural resources, especially water and forests, and there is a feeling that it could potentially be one of the wealthiest regions of India. However, several indicators reveal a different picture: in spite of some progress in a few of the northeastern states (for example Mizoram), overall growth rates over the past years have remained low, poverty incidence (especially in Assam) is high, there are still a number of areas subject to continued violence, and there is an abundance of reports documenting natural resource degradation, depleting the very assets that are usually highlighted as offering the greatest potential for growth and development in the Northeastern Region. Thus, in recent years, the region has missed out on the economic growth acceleration witnessed in much of India. The region's agriculture sector has been declining, and diversification into services and manufacturing has been inadequate.
2. This report has come about at the request of the Indian Government for the World Bank to focus more of its attention on the Northeastern Region in order to support poverty reduction and development in the region. Accordingly, the Ministry of Development of North Eastern Region (MoDONER) and the Bank devised a study that would provide a broad, regionwide view. This report synthesizes the study, which focuses on water and forests, two key interconnected resources of the region, and the institutional framework that deals with their management. These resources are abundant, renewable, and linked to significant development and growth options.

II. Objective, process, audience, and scope of the study

3. The overall **objective** of the study *Development and Growth in Northeast India: The Natural Resources, Water, and Environment Nexus* is to develop a broad vision for water and natural resource development and management leading to sustainable and equitable economic development and growth in the region. It also seeks to identify options for harmonizing interventions that are being carried out by agencies in the area of water and natural resource development and management. The specific objectives are:
 - To identify critical institutional reforms necessary for the more effective development and management of the region's water and natural resources
 - To develop an analytical framework that can help identify and prioritize high-return investments in physical and institutional infrastructure based on an inclusive and participatory approach
 - To create a platform for interaction of the relevant stakeholders, ultimately leading to desired institutional reforms.
4. The **process** followed in developing the study was multifaceted. It consisted of a range of stakeholder workshops, involving state and central government officials, experts, and

representatives of nongovernmental organizations (NGOs), carried out in 2005 in both Delhi and in Guwahati. In parallel, and based on the recommendations received during those interactions, a total of 14 Background Papers covering a wide range of topics related to water and natural resources in the Northeastern Region were commissioned (see annex 1) from knowledgeable experts and institutions. A first draft report was produced based on all of the above and discussed at state-level workshops across the region. The above documents have also been available on MoDONER's website at www.mdoner.gov.in. This final document incorporates the feedback received during the workshop held in New Delhi in June 2006 as well as the comments received on the final draft from MoDONER, the Ministry of Water Resources, and from various northeastern state governments. It specifically highlights the need to ensure that any developmental activities benefit local people in the Northeastern Region, an issue that was consistently raised in all stakeholder consultations.

5. The **audience** for this report are the central and state government agencies concerned with the Northeastern Region and the numerous nongovernmental organizations, donor and financing agencies, corporations, academics, and any other engaged citizens of the region.
6. The Northeastern Region is socially, culturally, and politically very complex and contains great environmental and natural resource diversity. It therefore needs to be pointed out that although this study draws on all of the above sources it is not comprehensive, and can only make a contribution to the ongoing development discussions in the region. Notably, the **scope** of the study with its focus on water and forests was defined based on initial discussions with a variety of stakeholders and on the important role that these natural resources could play in furthering development in the Northeastern Region. The study, by design, thus deals with the larger systemic issues and does not deal with services (such as water supply) or with environmental pollution issues, which are also important but could not be addressed at this stage. It also needs to be pointed out that the significant data limitations, both on the water resources and the forest and biodiversity sides, have restricted some of the analysis. As outlined in the report, filling the knowledge gaps and increasing public accessibility to available knowledge and data would be an important next step for the Northeastern Region in strengthening its basis for inclusive and participatory approaches to regional growth and development.

III. The Northeastern Region: Water and forest resources

7. The Northeastern Region has abundant water resources. One third of India's runoff flows from the Northeast through the Brahmaputra and Barak rivers. These rivers constitute India's National Waterway 2 (NW-2) and their basins contain seasonally flooded wetlands that sustain a broad range of biodiversity. There is an estimated 60,000 megawatts of economically viable hydropower potential, of which only about 2004 megawatts is developed or under construction. It is also clear that the abundant surface water resource imposes severe distress and costs on the region through frequent flooding and erosive processes and that this needs to be managed to improve economic development. The region also has a substantial unutilized groundwater resource.

8. The Northeastern Region can be physiographically divided into the eastern Himalayas, the northeastern hills, and the Brahmaputra and Barak valley plains. At the confluence of the Indo-Malayan and Palearctic biogeographical realms, the region contains a profusion of habitats characterized by diverse biota with a high level of endemism. The region is also home to more than 200 out of 450 of India's tribes, the culture and customs of which have an important role in providing lessons for biodiversity conservation.
9. The immense biodiversity of the Northeastern Region has made it a priority area for investment by the leading conservation agencies of the world. For example, the World Wide Fund for Nature (WWF) has identified the entire eastern Himalaya as a priority Global 2000 Ecoregion; and Conservation International has subsumed its eastern Himalaya "hotspot" into a wider Indo-Burma hotspot, which now includes all the eight states of the Northeast. The region is one of the endemic bird areas defined by Birdlife International, harbors a World Conservation Union (IUCN) center of endemism, and is an important subcenter for the origin of cultivated crops. The region's lowland and montane moist to wet tropical evergreen forests are considered to be the northernmost limit of true tropical rainforests in the world. Northeast India probably supports the highest bird diversity in the East, with about 836 of the 1,200 bird species known from the Indian subcontinent. The richness of the region's avifauna largely reflects the diversity of habitats associated with a wide altitudinal range. Assam hosts the entire known world population of the pygmy hog, 75 percent of the world population of the Indian rhinoceros and wild water buffalo, and a sizable population of Asian elephants and tigers.
10. Accordingly, the biodiversity of the Northeastern Region is of major importance globally and of great significance locally for citizens' livelihoods. In much of the literature about the region, its biodiversity is highlighted as one of its great assets and as an underlying resource for development. Suggestions abound with regard to improving livelihoods through developing forest produce, cultivation and export of exotic fruits and plants, harnessing of medicinal plants, and so on. Yet, the review undertaken for this study shows that there are still enormous knowledge gaps with regard not only to the biodiversity of the region, but also the potential sustainable uses of much of the flora. Despite the region's recognition as a biodiversity hotspot, biodiversity information is generally restricted to species inventories for specific locations, mainly the protected areas. Important data such as distributional patterns and population dynamics are unavailable, except for very few species. Documentation and systematic analysis of the region's biodiversity is vital to understand correlations between richness and distributional patterns, relationships between landscape variables and species composition, impacts of habitat fragmentation, and the role of biological corridors. All of these are vital for determining management strategies for the biodiversity resource and options on how to make use of it in a culturally appropriate manner for the sustainable improvement of people's lives.
11. Thus, appropriate water and forest development and management could provide benefits in the form of hydropower, agriculture, inland water transport, biodiversity conservation, reduced flood damage and erosion, longer dam-reservoir life, forestry, and ecotourism. These benefits, which would accrue at both regional and local levels, would in turn directly and indirectly increase incomes and enhance economic growth and poverty reduction.

12. Such accelerated broad-based development of the region could be achieved through a resource-led strategy within an institutional environment that has been appropriately reformed and strengthened. Institutions must be able to create and manage an environment of incentives and disincentives that encourage initiatives consistent with sound policy objectives, and discourage initiatives that channel benefits to a small group while externalizing social and environmental costs to the broader community.
13. Low connectivity with the rest of India is perhaps the greatest economic impediment in the region. Road access cannot be much improved, but improved inland water transport would benefit some areas. Another difficulty is the civil unrest associated with conflicts between and within some of the region's states. In general, development and growth can help reduce conflict by enlarging the economic pie, but a risk of resource-led development is the creation of localized assets that then become foci of intensified conflict between potential winners and losers. This report highlights the need to manage this risk.

IV. Institutional environment

14. This report outlines an analytical framework drawing on institutional, resource, and development economics, and on water and other natural resource management approaches. Broadly, these imply that for a country or region to benefit from its natural resource wealth, certain institutional elements must be present. These include clear institutional arrangements; participatory decisionmaking by the different levels of stakeholders (ranging from state governments to water users and forest-dependent producers); clear and transparent rules and regulations; and equitable enforcement of those rules and regulations. In addition, an integrated management system is required with regard to river basins and natural resources.
15. Little of the above exists in the Northeast today. Certain key themes keep emerging in all sectors, notably (a) the central government has taken on a large role, partially due to weak state capacity, for instance in areas such as water resources; (b) institutional arrangements are very complex but at the same time incomplete; (c) the natural resource knowledge base is incomplete and partly inaccessible; and (d) local stakeholders question current approaches and their benefits to local populations. The region is plagued by large fiscal deficits and poor service quality, including poor infrastructure provision, despite generous transfers from the central government. Institutions continue to overfocus on top-down accountability. Public sector goals are defined in terms of readily observed and assessed physical outputs rather than in terms of desired functional outcomes: typical criteria are embankment length constructed rather than flood protection provided, and number of schools built rather than education quality. But physical outputs are meaningful only insofar as they achieve desired functional outcomes; and frequently, outputs and outcomes are not well correlated.
16. A further challenge is the need for an integrated approach that increases cooperation at and between regional and local levels. This involves developing a shared vision of costs and benefits through strategic planning and infrastructure interventions that improve the lives and livelihoods of communities and citizens.

V. Key findings of the study

17. One of the key messages of the study focuses on the major benefits that **regionwide investments** can provide for the Northeast. This includes not only investments in “hardware” (for example construction of infrastructure), but also regional “soft” investments, such as coordinated research and information sharing. Major benefits can be derived from hydropower; inland water transport; joint water resource management, including flood and erosion management; biodiversity research and cataloging; and joint creation of ecotourism approaches and related infrastructure. Cooperation across states can be designed to ensure that these benefits are equitably distributed among all stakeholders.
18. At the same time as these cross-regional investments are elaborated and implemented, it is also of major importance that benefits are created at **local levels**. This type of activity would focus, for instance, on community-based forest management, built on local traditions; creation of access to local markets for produce; enhancement of local inland water transport options; watershed management and local erosion control; local adaptation to floods; and management of *beels* (seasonally flooded wetlands).
19. Clearly the latter group of activities, although attractive, will not make a major dent in the region’s development prospects if it is not augmented by the larger investments that increase access to electricity, reduce vulnerability caused by floods and erosion, and improve the Northeastern Region’s connectivity by widening the range of transport options. For these reasons, this report strongly emphasizes that local investments and interstate cooperation need to go hand in hand if benefits are to be maximized.
20. A further crucial element related to the above is the **institutional framework and the incentives it provides for stakeholders to act in a productive way**. Interlocutors and authors for this study have been surprisingly eloquent in their openness about the weaknesses in the institutional arrangements that have governed the Northeast. The Planning Commission’s 2005 publication *Yojana* outlines in several articles the need to reduce leakage and to increase accountability in order to fully reap the benefits of the large financial investments that are made annually in the Northeast. It is thus clear that envisaged benefits from investments may not materialize if the institutional framework is not addressed upfront.
21. Each sector covered in the present study has its own institutional framework and its own strengths and weaknesses, and the solutions for each sector will be different. However, there are also common themes across the sectors, indicating the need for more transparency and involvement of stakeholders at the different levels; redesign of organizations (for example the Brahmaputra Board and the Forest Service) and their internal incentives to provide better services; focus on investments reaching local stakeholders (for example for flood warning and management systems or for improved livelihoods from forest produce); and changes in the way budget allocations are made.

22. This type of change requires a specific in-depth analysis by sector. This study has carried out the overall diagnostics in order to arrive at priorities. Its multisectoral and regional scope, combined with limited time, did not permit development of detailed proposals for revised institutional arrangements for each sector. However, it outlines the institutional commonalities and challenges across sectors in the Northeastern Region and points to concrete priority actions to be taken forward.
23. In the following subsections, the study's main findings are presented by topic.

The case for interstate cooperation in the Northeastern Region

24. There clearly is a strong case for international and interstate cooperation. This goes primarily for the water-related sectors, but also for forestry and biodiversity. The huge rivers, which are the lifeblood of the region, cut across several states. Their strategic management and development could generate the greatest impact at the regional level, be it through reduced erosion (providing communities with assurance that investments in industries and infrastructure are sustainable); flood mitigation (saving millions of Assamese farmers from devastating effects on a recurring basis – and possibly even more frequently than now, depending on future climate change); or through hydropower generation. A vision for the Northeast is needed, one that sees development instead of stagnation, and focuses on the benefits that can be derived through cooperation. For this to happen, the northeastern states need to work together in a cooperative framework, for instance within river basin organizations as active and strong stakeholders, negotiating a long-term view of integrated regional development.
25. While the study has focused primarily on the northeastern part of the Brahmaputra and Barak basins, it also highlights that there would be major benefits to be derived from international regional cooperation between India and its upstream and downstream neighbors. Cooperation will become all the more necessary as climate change affects the basins' hydrological regimes. Cooperation on information sharing and joint management and development action would benefit all basin countries, and notably the Northeastern Region, by helping them to cope with increased and possibly more erratic river flows, and to harness the potential that these transboundary basins provide, for example in the area of inland water transport.

River basin management

26. The experience with the current institutional arrangements for water resource management in the Northeastern Region has shown that without active cooperation by all stakeholders, neither development nor management of the northeastern rivers is likely to occur. Modern water resource management approaches highlight the need for decentralization of decisionmaking "to the lowest appropriate levels". For a number of decisions, central and state governments should certainly be included. For many decisions, other stakeholders, for example communities affected by floods or erosion on tributaries, should also be included.
27. The findings of the study therefore strongly support the plans outlined by India's prime minister to develop a new river basin management institution that would work across the entire Northeast and to which decisionmaking powers would be devolved, with strong participation by the states. This increases options to develop stronger interstate cooperation in the Northeastern Region, and to optimize the benefits from investments

in flood and erosion management, hydropower, and inland water transport, through a comprehensive and integrated approach. An appropriate research agenda could be established within this institution supporting decentralized investigation of groundwater resources, wetlands, and critical watersheds.

28. A crucial ingredient would be a high level of transparency and consultation with stakeholders. This would bring more information into the system, thereby enhancing the decisionmaking process, and it would also support socially beneficial outcomes. Institutional performance would be greatly improved through increased transparency and accountability to a wider public (for example, public access to draft plans and data).
29. A distinction needs to be made between the policy-setting, planning, and regulatory functions of an interstate river basin organization and the infrastructure implementation functions of agencies in the different water-related sectors. International experience in past decades has shown that it is generally advisable to separate the construction function from other functions, since water resource organizations easily get drawn into construction only and neglect their vital management mandate. It is not within the scope of this study to outline the specific sector arrangements. The background documentation produced for this report shows, however, that India's power sector, for instance, already successfully distinguishes between regulatory and power development mandates. Similarly, the inland water transport sector has its own dynamics. A river basin management framework should be appropriately crafted to tie into these sectors to enable them to function in the Northeast, but within an integrated perspective. The flood management functions of existing state departments would need to undergo a similar analysis.

Hydropower, flood and erosion management, and inland water transport

Hydropower

30. This report shows that hydropower from the Northeastern Region is of great importance to the realization of India's development potential. And given the current socioeconomic and development status of the Northeast, the hydropower sector also emerges as one of the best opportunities for development in the region, provided that the hydropower projects are developed in a manner appropriate for the region's social and environmental contexts. Hydropower project revenues could potentially double the region's net state domestic product.
31. In addition to the direct financial benefits, other potential benefits include reduced flood damage in Assam if storage facilities were part of the hydropower projects in Arunachal Pradesh, and the substantial employment generated by the significant investment for the priority projects, which in turn would have an impact on sectors such as services, transport and tourism. Also, transport infrastructure to remote areas, built by the hydropower projects, would be of some importance to the region. Finally, benefits would include improved navigation and fisheries and considerable augmentation of lean season flows.
32. An issue to be dealt with is the problem of power transmission and cost sharing between projects spaced over time, given the limited right of way available between the Northeastern and Eastern regions. This issue is fundamental to hydropower development in the Northeast because without development of a transmission corridor,

the power produced will only have the limited market of the northeastern states. Accordingly, hydropower development would be slower and it would also be hard to justify the largest developments, which are often those with the greatest potential for issues such as flood control. Thus, the transmission corridor needs to be built for the first project, but will not be fully utilized until four or five such projects have been commissioned. Since the first project cannot bear the full cost until the others come on line, there needs to be an agreement on how this is funded.

33. Thus, hydropower may be harnessed only in a few states of the Northeast, but the potential development impacts - depending on which path is chosen - would build up regionwide. How much of these state-level production and revenue receipt benefits would accrue to the communities and citizens would depend on a number of factors, including governance. Equitable benefit sharing, spending the net additional revenue on purposeful community development works, would be a key challenge to the northeastern states and to the central government agencies involved.
34. For developing storage projects, it would be important to adequately and concertedly address the critical challenges of protecting the livelihoods and the cultural and territorial identity of the tribal communities and the environment. This would imply serious examination of the tradeoffs of different development options from an integrated point of view that fully takes into account the interests of the Northeastern Region and its citizens.
35. There is an inherent tension in the tradeoffs between run-of-the-river schemes (which produce electricity and revenues, and reduce submergence area) and storage schemes (which produce electricity, revenues, and flood moderation and irrigation for downstream states, but have a larger submergence area). Renewed efforts are needed to ensure long-term interstate or intercommunity cooperation in the interest of larger gains based on mutually beneficial interdependencies and tradeoffs. Agreement and consent of the states and the communities would be likely to take time. Therefore, it would be prudent to study the optimal development of the potential and see if there are low-impact projects that would allow some development to take place while agreement is reached on sites with larger storage potential. This could ensure some progress while not ruling out storage sites. This will, at least, ensure that dam sites, which would bring major flood moderation benefits to the millions of downstream poor, are not lost forever by being developed with a short-term view without exploring all possibilities of greater regional benefit.
36. The thrust of the development agenda needs to be directed towards using the region's comparative advantage, part of which includes developing its hydropower potential. However, to accelerate poverty reduction and assure inclusive and sustainable growth attention must be paid to the distribution of losses and gains, including those arising from different types of hydropower infrastructure. Ultimately people will support development if they foresee economic benefits and if the development path is culturally and socially accepted. This requires establishing credible mechanisms to deliver on policy commitments and calls for greater inclusiveness through the sharing of benefits. This report outlines key elements of a benefit-sharing approach.

Flood and erosion management

37. The basin of the Brahmaputra River is among the most flood prone in the world, followed closely by that of the Barak River. Floods affect an annual average of 1.25 million hectares of land, but in some years they affect more than 3.8 million hectares of Assam's total area of 7.58 million hectares. Such extensive floods inundate at least 2,000 villages in addition to destroying other infrastructure.
38. Despite extensive efforts on flood control, disastrous flooding continues to affect large segments of the population in several states, and to discourage investments. Embankments are only partially effective for numerous reasons: (a) they can contain only floods up to a certain magnitude; (b) they usually have gaps where tributary streams enter the embanked river; (c) they are susceptible to failure from river erosion or geotectonic instability; (d) they are often inadequately maintained; and (e) they may be deliberately breached to release impounded water.
39. The social disruption and costs associated with flooding have been rising, partly because of increasing human occupation and associated economic activity but possibly also due to increased magnitude and frequency of floods.
40. In response to flooding between fiscal years 1983 and 1987, six of the eight northeastern states sought flood relief from the central government amounting to US\$195.5 million and received assistance of US\$36.1 million. The flood-prone area in these states was estimated to be 3.6 million hectares. Assam, which contained 88 percent of the flood-vulnerable area, sought and received assistance amounting to 77 percent and 72 percent respectively of the totals. Between 1999 and 2004, when average annual flood damage in Assam was estimated at US\$163 million, the allocation of the Central Relief Fund averaged US\$21 million.
41. In addition, erosion is a major problem. It is estimated that an area of 386,000 hectares has eroded since 1954. This in turn has reportedly affected more than 90,000 families and about 2,500 villages, and translates into an average annual erosion rate of about 8,000 hectares. Erosion not only affects Assam but also upstream Arunachal Pradesh.
42. The existing plans and strategies to improve water resource management in general, and flood management in the Assam valley in particular, reflect the outcome of considerable and careful analysis of available information. However, there is a need for more consultation and transparency regarding the Brahmaputra master plan. It would also benefit from more consideration of policy options to promote adaptive land use, particularly with respect to agriculture. In practice this would involve shifting agriculture production systems to the rabi (*boro* rice) and kharif seasons, relying heavily on extraction of groundwater and thereby reducing reliance on the kharif II season, when crops are most susceptible to flooding. Since floods would not be eliminated, and as populations in the Northeast will continue to expand, additional measures would be needed to ensure stable incomes and food production.
43. Fish are an important source of protein in the diet of the people of the Northeastern Region. The annual production of fish is reportedly about 170,000 metric tons, compared to the estimated requirement of about 280,000 metric tons. From the perspective of their contribution to groundwater recharge, their potential to moderate smaller floods, and

their role in providing fish habitat, the lack of attention to the wetlands and beels should be of some concern.

44. It is not clear to what extent climate change has been incorporated into the existing Brahmaputra master plan. An assessment of the implications of climate change for hydrological regimes and water resources in the Brahmaputra basin using model simulations developed by the Hadley Center indicates that, after an initial increase of flooding in the coming decades due to snowmelt, by the year 2050 the average annual runoff in the Brahmaputra River will decline by 14 percent. In another model, according to information from the Ministry of Water Resources, studies carried out by the Geological Survey of India (GSI) indicate that glaciers may recede due to subnormal snowfall, higher temperatures during summer, less severe winters, or a combination of all of these factors. Under this scenario there would be less increase in flooding than predicted by other models.
45. Thus, the exact impacts of climate change are still under investigation. It is clear though that climate change is likely to have extensive impacts on the land-water system. Further research is needed, as well as the development of adaptation measures that incorporate climate change responses into long-term planning. Dealing with existing climate variations through good construction quality and strengthened operation and maintenance is also good preparation for dealing with climate change, since infrastructure will need to respond to conditions that approach the limits of their design.
46. The erosive potential of the Brahmaputra River is extremely high and has led to frequent pulling back or “retiring” of flood control embankments, with adverse social consequences. Assam has made limited efforts to avoid loss of embankments by constructing spurs at right angles to the embankments in some vulnerable locations. Discussions in Assam indicate that the methods used have been fairly successful and that considerable benefits would accrue from substantial expansion and acceleration of spur construction where embankments are under immediate or near-future threat.
47. In summary, improvements in systemwide flood and erosion management in various states, including Assam and Arunachal Pradesh, could be achieved with strategic investments at high-value priority points. Incentive structures at national and state levels, including budget allocations, need to be changed to ensure appropriate operation and maintenance of existing infrastructure. There is also a need to strengthen communities’ ability to cope with floods that occur despite investments in erosion and flood management. The linkage to overall water resource management in the region is clear, since state-level activities would need to tie into a regional strategic approach.

Inland water transport

48. One of the key development constraints for the Northeast over the past decades has been its geographical isolation. Certainly the advances in air flight have brought markets closer to the Northeast, but the relatively high proportion of bulky goods in the region’s economy requires the further development of a means of transport suited to the movement of such goods to other regional markets – inland waterways. Besides their relative cheapness for bulk transport, inland waterways follow shorter routes to the Northeast than those taken by road or rail, and are also still available during monsoon or flood seasons.

49. With the renewed focus of the Government of India on the development of inland water transport and the implementation of ongoing improvement projects, it is expected that NW-2 can develop into an efficiently functioning waterway with adequate infrastructure. The development of NW-2 and of waterways in the tributary rivers would increase the opportunities for economic growth and employment and would accelerate the development of the hinterland. Cargo movements of agricultural produce, basic commodities, coal, limestone, petroleum, and bitumen offer considerable growth potential.
50. With further development of NW-2, 6 million metric tons are projected to be transported by 2020, a sevenfold increase compared to 2004, and the projected increase in economic activity as a result of the development of inland water transport would create an additional 27,000 jobs. Related development and multiplier effects in the hinterlands as a result of this increased activity have not been projected, but are estimated to be significant.
51. Institutional challenges include integration of inland water considerations into an overall regional water resource and development framework and provision of incentives for private sector investments. This structure would need to address the policy, institutional, and regulatory issues to be tackled within the framework of overall development of the waterways. It would also require an analysis of how to effectively stimulate investments in ships, ferry services, and transportation enterprises in order to encourage private enterprise to make optimal use of the upgraded waterways.
52. Trade and commerce between India and its neighboring countries would be accelerated by the development of waterways between Nagaland and Myanmar, between Mizoram and Myanmar, and between Tripura and Bangladesh. A key issue in making inland water transport viable for northeast India is increased cooperation with Bangladesh. Such cooperation has brought considerable benefits in the past five years, and there is scope for further analysis of mutually advantageous options for intercountry waterway linkages, with the ultimate goal of formalizing agreements as part of a stable trading environment in the region.
53. Inland water transport needs to be integrated with other modes of transport. Accordingly, institutions need to be set up in a way that optimizes multimodal approaches to enhancing the Northeast's transport system.
54. Passengers and cargo are moved via inland water transport in both the larger-scale organized sector and the smaller-scale less-organized sector. At present, there are no data regarding the transport volumes within the small-scale sector. However, this mode of transport is essential to small or remote communities for the transport of agricultural and commercial products to and from regional markets and growth centers, especially during the monsoon and flooding season. A case study on passenger transport in and around Neamatighat showed that privately operated small-scale ferry services operated faster and more regularly than the government-operated ferry. Therefore, relatively small investments in transport facilities for private or small-scale transport services would increase the strategic connectivity of rural communities through ferry services and small goods transport. An analysis should be undertaken to identify strategic nodal points through which increased access to markets, education, or health services might bring benefits to the region.

Forest management

55. The Northeastern Region boasts a vibrant tradition of community-based forest management. Current incentives seem to work against rather than for supporting this tradition. There is a need to strengthen incentives for communities to develop or redevelop their forest management skills, while adapting them to changing demographic, social, and economic pressures. There is also a need to change incentives so that forest departments favor community-oriented rather than centralized approaches. Such a realignment could involve, for example, changing the relevant forest classifications or adapting forest department budget allocation procedures.
56. The importance of community involvement in forest management has gained widespread acceptance in the forest sector globally and is critically important in the Northeastern Region, where the vast majority of upland forests are legally owned by rural villages. There are attractive opportunities in northeast India to create management partnerships that respect the legal authority of communities and work through indigenous institutions drawing on centrally funded schemes as well as international conservation programs. By empowering and enabling traditional institutions and building modern management capacities within them, the forest departments will have viable partners to craft new landscape management systems that rely on networks of villages. In return, communities will be able to develop new resource management plans that address forest conservation and livelihood issues, and gain formal tenure security for their ancestral domains. Retaining ancestral domains under communal tenure may be one of the most effective strategies for maintaining forest cover and protecting biodiversity in a manner that respects indigenous rights to natural resources and livelihood needs. Given the population increase in the Northeastern Region it will be important to support community efforts to intensify land productivity, especially on sites where terracing and irrigation are possible. Agroforestry systems with a mix of commercial products, including timber, fiber, spice, and medicinals, would also help to generate income, taking pressure off steeper slopes and allowing for longer fallow periods in areas of *jhum* (shifting cultivation). Extension of family planning and health services is also a priority in the hills, where fertility and growth rates are often high, placing continued pressure on the resource base.

Biodiversity and carbon trading

57. This report highlights the region's wealth of biodiversity. It also reveals significant gaps in existing knowledge. Both flora and fauna in the Northeastern Region are under threat due to deforestation, mining and quarrying, *jhumming*, charcoal making, construction of reservoirs and dams, overharvesting of medicinal plants, drying up of wetlands, and overfishing and pollution of water bodies. In addition, conflicts between development and conservation, coupled with general political conflict in the region, are likely to have negative impacts on biodiversity conservation.
58. The dream of the Northeast to use its biodiversity wealth sustainably and beneficially can only be realized if mobilization takes place at both regional and local levels, for example by fully involving local communities in regionwide efforts to catalog and document existing plants and their potential uses. Only if knowledge and awareness come together can potential benefits be harnessed, be it through medicinal plants or ecotourism. Favorable institutional development would be stimulated by the emergence

of a leader or champion, perhaps an agency or a research consortium consisting of the region's universities, to integrate biodiversity-related work.

59. If the biodiversity wealth is to be maintained and developed to the benefit of the region's citizens, a number of activities in the region could be further explored (some are ongoing, but not as yet in a comprehensive and strategic manner). This includes assessment of capacity-building needs in the forest departments, and a focus on protected area management plans. Many protected areas do not have management plans, or their effectiveness is very limited. Besides strengthening these systems, other potentially advantageous activities include cataloguing of flora and fauna and making the information widely available, research in the use of plants, working with communities to improve their livelihoods through increases in local productivity, and collaboration between the different stakeholders.
60. With regard to carbon trading, the current official forest classification system could be reexamined to more accurately assess the eligibility of the region's forests for carbon credits under the Clean Development Mechanism of the Kyoto Protocol. Again, interstate cooperation to bring about change would be highly beneficial, since a starting point would be to agree on a forest classification. An outcome of the analysis is a recommendation that the focus should not be specifically on stand-alone projects, but rather on activities that complement projects dealing, for example, with land degradation, watershed issues, and species and biodiversity, to create greater benefit and opportunity. In this way carbon funding could generate benefits for local land users and owners as well as for the local and global environment. The global carbon finance mechanism itself is still in its infancy. As India is a participant in this mechanism, it will have to analyze its effectiveness in harnessing benefits for the country's various regions, including northeast India.

VI. Challenges for the Northeastern Region

61. The analytical framework developed for this study outlines which different elements of an institutional framework influence stakeholders' decisionmaking. They can be defined as (a) formal, informal, and indirect institutional arrangements; (b) instruments for natural resource management (such as forest and water use rights, monitoring systems); and (c) the institutional management form (for example government agencies at different levels, community-based groups).
62. Based on the findings of this study, what can be said about the way in which these elements influence water and natural resource management and use in the Northeastern Region, and what are the implications for the selection of particular options for development and growth?
63. Although this report cuts across many diverse sectors and generalizations are difficult, certain key themes emerge with regard to all sectors, notably the large role of the central government in decisionmaking and very complex but at the same time incomplete institutional arrangements. The following subsections outline these issues with reference to the water-related and forest sectors and consider the needs and possible options for institutional change.

Water-related sectors

64. In the water-related sectors the formal institutional arrangements (the Constitution, the River Boards Act) give central government the option to create interstate river basin organizations. The Brahmaputra Board was created under the separate Brahmaputra Board Act. The states have been playing a limited role in these regional endeavors. The consequences seem to have been counterproductive. On the one hand a central agency can play an important role in addressing interstate tradeoffs and guiding the overall strategic objectives of water policy and development. But for this it needs strong stakeholders. It also needs a strong mandate and mission, financing, and transparency in decisionmaking. Otherwise there is a risk of creating an overdependence on the Centre and eroding accountability to stakeholders.
65. At times, structures meant to deliver direct benefits (such as embankments) have been unpopular with those they are designed to protect. There is a need for the state-level agencies to consult local communities and stakeholders.
66. The states have focused on what is of most importance to them, for example flooding and erosion in Assam, irrigation in Mizoram, and lately some hydropower development in Arunachal Pradesh. However, the relevant state departments are heavily dependent on central government for financing, especially in the case of recurring natural disasters but also for financing of infrastructure, such as hydropower facilities or embankments, and for their maintenance. Their capacity constraints may also hamper their full participation in the Brahmaputra Board.
67. In the inland water sector some progress has been made by improving the transit protocol with Bangladesh, thus increasing trade options, but border transit regulations are still hampering this means of improving the interconnectivity of the Northeast and its surroundings.
68. Overall, in the water-related sectors, it seems that links into community-based institutional arrangements are limited or do not exist, be it for watershed management, early warning systems, or adaptation to the recurrent floods. This goes for both state and central government initiatives.
69. These institutional arrangements also influence the management instruments that have been chosen and the way they are being implemented. There is significant knowledge about water resources in the region, but the knowledge is still incomplete and it is partially inaccessible. Management instruments for water resources include such diverse measures as functioning river erosion monitoring systems and water allocation systems through concessions (for example hydropower or irrigation uses). Such instruments are concentrated in central government agencies and the data are not available to other stakeholders in general. In addition, the systems seem to be outdated.
70. The organizational structures for water have then logically also become very center-focused, with, for example, the Brahmaputra Board and the Central Water Commission playing the driving roles with regard to planning and knowledge creation, archiving, and use. There have been contradictory indications in the course of this study as to the extent to which the states, which have representatives on the Brahmaputra Board, could play a bridging role between this regional organization and the local stakeholders. It was suggested by many during the course of this study that local stakeholders should be

active participants in the organizational structures to ensure that benefits flow from these initiatives to local populations.

71. It is not surprising then that there is a lack of alignment between the articulated aim of the region's development, namely prosperity for the Northeastern Region as a whole, and the actual implementation of it. With a lack of access to data and information by the wider public, decisionmaking takes place within agencies but without much outreach, and accordingly accountability to the public is very limited. Global experience has shown that such a situation leads to low performance and to little consideration of impacts on the ground, as indicated by the degree to which investments effectively reach beneficiaries. Stakeholders (water users, marooned flood victims, citizens without access to basic electricity in rural areas, young people without jobs) then feel abandoned and look for other sources of livelihood, for example by leaving the region or even by participating in violence.
72. The challenge then is to reverse this trend and instead build a more accountable institutional framework. This implies strong political will to counteract the tendency of a society to follow the path it has already taken due to the political or financial cost of changing it ("path dependence"). A case in point is the Brahmaputra Board: there seems to be widespread consensus that the board needs to perform better, but with its current setup it is not able to deliver on its regional mandate. There is, therefore, need for an updated mandate and, perhaps, a more broad-based organization to address the intraregional concerns.
73. Similarly, improvements in inland water transport, so important for the Northeast, are dependent on potentially lengthy negotiations with the Government of Bangladesh to establish the protocol provisions for transboundary water transport routes.

Forest sector

74. In the forest sector there is a strong tendency towards Centre-led activities through the Forest Act, while more informal community customs and traditions are slowly (or rapidly?) dying out, thus diminishing options for enhancing livelihoods in the Northeast in a strategic and sustainable manner.
75. The institutional arrangements, as expressed for instance in the Constitution and in the Forest Act, take a primarily national view, with little consideration for the special multiethnic mosaic in the Northeastern Region. As amply analyzed in the report, the Joint Forest Management mechanisms are functioning in peninsular India where tribal people who have long been marginalized are now afforded access to land and forests. In the Northeast the situation is different because much of the land is owned by tribal communities. Accordingly, the formal institutions need to be adapted to the realities of the Northeastern Region and linked into informal institutional arrangements by incorporating tribal customs and traditions in order to provide incentives for rural communities to more sustainably manage their forests. This would then also provide a better platform for developing sustainable ways to use the biodiversity in the Northeast for the benefit of local people and of regional development.
76. Also with regard to forests, the resource management instruments, including monitoring devices, cataloging (for example of biodiversity), and definition of forest use rights, are strongly conditioned by the centralized approach defined by existing formal

laws and regulations. Plans do exist, but incentives (for both government agencies and stakeholders) to apply them seem to be lacking, as very few are being implemented. The organizational management form for forest management requires review in order to create functioning structures to enable forest agencies at different levels to work jointly with communities to find ways of building sustainable livelihoods.

77. Given the current institutional setup and the ensuing incentives for stakeholders, the challenge for the Northeastern Region is to move from a Centre-focused approach to one that gives more say to the states and to the communities within the states. The creation of structures that permit a regionwide development vision, and at the same time a vision that enables a development process at the local level, is complex. It also implies that states have to take on more responsibility for their own development.
78. Such an approach would aim to enhance cooperation across the region in order to help establish a solid basis – in terms of physical and institutional infrastructure – for joint regional action, growth, and poverty reduction. As the study findings have shown, there are significant benefits to be derived from joint action built on a benefit-sharing vision. Action steps to implement such a vision would include strategic planning and infrastructure interventions at the macro or regional level, while simultaneously improving the lives and livelihoods of communities and citizens at the local level.

VII. Recommendations for priority activities

79. This section considers priority actions that would help reshape the institutional framework to enable a more effective regional development path.
80. Table A shows, in a simplified manner, the priority activities that might address the challenges implied by the integrated approach described in the preceding sections. The left-hand column designates the sector, while acknowledging that in practice there are some overlaps among sectors. The middle column shows regional-level action steps that would be considered high priority in order to create a regional enabling institutional and physical framework to enhance development activities. The third column identifies activities that can be undertaken in parallel to stimulate local development, based on the different states' needs and priorities.
81. From the sector-based analyses in this report the conclusion can be drawn that regional-level activities are a prerequisite for local-level activities if longer-lasting results are to be achieved. For instance, improved forest productivity is unlikely to contribute significantly to local development without parallel improvements in market access, through upgraded road or waterway networks, at regional level. Local community adaptation to floods will only be helpful if larger-scale flood and erosion management investments are undertaken. This is also the reason why institutional change needs to be brought about at the higher levels of natural resource management and why it is a necessity if benefits from physical investments are to be reaped. Changes at local levels alone will not suffice to make an impact on the huge development agenda in the region.

Table A. Priority activities at regional and local levels in the Northeast

Sector	Regional-level activities	Local-level activities
Water resources	<p>Create an appropriate institutional framework for river basin management, including an interstate river basin organization with a clear mission and mandate</p> <p>Undertake comprehensive strategic participatory river basin management and planning covering several states (Brahmaputra and Barak basins) including tradeoff analysis of different development and management options (e.g. floods, hydro, wetlands, environmental flows)</p> <p>Implement and maintain effective water monitoring systems</p> <p>Develop and support regionwide and basin-level research on water resources</p> <p>Create new or align existing state agencies for water resource management that can effectively interact with the interstate river basin organization</p>	<p>Develop groundwater resources</p> <p>Manage wetlands, restore and preserve beels</p> <p>Manage watersheds</p>
Flood and erosion management	<p>Develop and implement an operational plan to enable strategic investments in annual maintenance of flood management structures</p> <p>Carry out structural interventions to enhance erosion management</p> <p>Develop an appropriate flood and erosion monitoring system with information available to all stakeholders</p> <p>Develop a functional flood warning and community alert system</p> <p>Develop a functional plan to start addressing drainage issues</p> <p>Review and adjust existing agencies' internal incentive structures (including budget allocations and accountability structures) to enhance delivery of services</p>	<p>Enhance communities' capacities to "live intelligently with floods" through strengthening coping mechanisms, supporting and learning from innovations, improving basic health services</p> <p>Develop local capacity to link into and respond to a broader flood warning system</p> <p>Analyze local needs for watershed management to control local erosion and landslides in tributaries - "landscape management" - and work with communities to develop local watershed management actions</p>
Hydropower	<p>Assess potential benefits and tradeoffs between hydropower and flood management benefits/costs and continue dialog on different options</p> <p>Develop scenarios to harness hydropower at the basin level (sequencing, integration with for example considerations for flood management benefits, inclusion of local stakeholders)</p>	<p>Develop small/mini/micro/pico hydel projects in a more targeted manner</p> <p>Ensure benefits (for example electrification of villages, job creation) and minimize costs (for example displacement, erosion of cultural values) at local level from large hydel by developing and implementing</p>

Sector	Regional-level activities	Local-level activities
		functioning benefit-sharing mechanisms to improve people's livelihoods
Inland water transport	Analyze and develop opportunities for linkages between India and its neighbors in order to break Northeastern Region isolation and enhance options for trade Invest in multimodal transport infrastructure strategically, reinforcing the existing NW-2 to support regional connectivity with neighbors and peninsular India	Develop local-level infrastructure for community water transport on secondary rivers, improving access to markets and to social infrastructure (for example health, education)
Forest and biodiversity management	Build up a regional systematic knowledge base on biodiversity and forest resources Develop institutional arrangements that take into account the specific social and cultural background of the Northeastern Region Assess options for regional ecotourism and create an enabling institutional framework Carbon trading: Reclassify northeastern forests to enable carbon trading	Support communities in recovering and building on their traditional structures for forest management Develop appropriate knowledge sharing and extension service mechanisms for rural communities to develop sustainable economic activities (for example diversified agriculture, ecotourism) Work with local communities to find out their interest in preserving forests through carbon finance

VIII. Conclusions

82. This report shows the significant potential that exists in the Northeastern Region for its renewable natural resources to generate benefits at the regional and local levels. It has also been shown that these resources alone, without enabling institutional frameworks and an integrated vision, have not brought and will not bring development to the Northeast. The report makes an initial effort to develop such an integrated view and to show how the different sectors are linked to each other, and also how the macro and micro levels are connected.
83. With a targeted thrust that comprises central government and state stakeholders and, importantly, local communities and stakeholders, the natural resource curse – the tendency for resource-dependent economies to perform poorly – does not need to become a reality in the Northeast.
84. The natural wealth of the Northeastern Region is well acknowledged. However, in the available documentation and literature, there are few suggestions on what to do in order to develop them to the benefit of the region's citizens. This report highlights that for all of the topics covered in the study, institutional change is the necessary first step. Incentives need to be changed at central levels as well as at state and local levels in order to direct work towards the region's developmental goals. Key among these changes are:

- Provision of incentives to encourage interstate cooperation across the Northeastern Region
 - Devolution of decisionmaking power to appropriate lower levels by moving to a participatory approach where the various stakeholders participate more actively in the development process
 - Transparency in decisionmaking in order to increase the accountability of the different actors.
85. It is always easier said than done to change institutions; such change requires the introduction of incentives, including economic incentives, supported by political will. With India moving into a new era of economic liberation encouraging free enterprise, the Northeast should not be left out. Thousands of young Northeasterners are waiting for a chance to productively contribute to their home region. Thus, with some of the changes advocated here taking place, a process would be set in motion that could support them in this endeavor. It is vital that this process includes mechanisms for equitably sharing the benefits to be derived from development and focuses not only on the big-ticket items that support broad-based, long-term growth, but also on those complementary activities that have immediate impact on poverty reduction at the community level.

1. Introduction and background

- 1.1 India's Northeast is rich in natural resources. While in terms of development – contrary to its true potential – the region lags behind the rest of the country, much has been changing in the Northeastern Region. Over the past decades economic development, population growth, growing educational opportunities, commercialization of livelihoods, and increasing interactions between the northeastern peoples, peninsular India, and the southeastern neighbors have started to change the region's social and economic fabric and the outlook on development challenges. This report examines ways in which the region can strategically harness its natural resources to unleash its development and growth potential in ways that are inclusive and environmentally sustainable.
- 1.2 The report synthesizes the results of the study *Development and Growth in Northeast India: The Natural Resources, Water, and Environment Nexus*, initiated in 2004 and carried out jointly by the Ministry of Development of North Eastern Region (MoDONER) and the World Bank.
- 1.3 The study was triggered by the request of the Government of India that the World Bank focus more attention on supporting development efforts in the Northeastern Region, potentially one of the richest regions of India, but in fact one of the poorest.
- 1.4 Before embarking on any further engagement by the Bank, which hitherto had focused on Assam, it was essential to gain knowledge and understanding of the underlying opportunities, constraints, and priorities for development in the Northeast. Therefore, MoDONER and the Bank devised the study with the focus outlined below.

The natural resources, water, and environment nexus in the Northeast

- 1.5 India's Northeastern Region consists of eight states, namely Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura. With a total population of 39 million (2001 census) and covering an area of 262,179 square kilometers, the Northeast is relatively sparsely populated compared to much of India. As shown in table 1, however, population density in the northeastern states varies widely. Assam and Tripura are the most densely populated (with over 300 people per square kilometer, around the Indian average) while Arunachal Pradesh is the least densely populated (13 people per square kilometer).
- 1.6 The Northeastern Region is characterized by the great diversity of its peoples. There are more than 200 tribes and, as shown in table 1, several states are primarily tribal. At the same time population growth over the past decades has been significant and has put increased pressure on land, forest, and water resources. The tribal traditions in much of the Northeast and the relations of tribal peoples to their environment are very important to consider in any analysis of management options for natural resources and environment in the region.

"The Northeast requires a massive development thrust to make up for lost time and put it on a fast track. It has vast natural resources in its biodiversity and water wealth. These should be suitably exploited to raise living standards and the quality of life of all the people, with equity and safeguards to prevent degradation of the natural and socio-cultural environment."
(Shukla Commission Report 1997)

- 1.7 The Northeast has an abundance of two key renewable resources¹ that are significantly linked to development and growth options – water and forests. These in turn are connected to each other in a variety of ways. They, and the institutional framework dealing with their management, are the focus of this report.

¹ This report does not deal with nonrenewable resources such as oil, gas, and coal.

Table 1. States of the Northeast: Selected population and natural resource indicators

State	Population Number of people 2001	Total area Square km	Population density Persons per square km 2001	Forest cover % of total area 2001	Rural population % of total population 2001	Per capita income 2001 Per capita net state domestic product	Persons living below poverty line % of total population 1999-2000	Scheduled caste population % of total population 1991	Scheduled tribe population % of total population 1991
Arunachal Pradesh	1,091,117	83,743	13	81.3	79.6	9,013	33.47	0.5	63.7
Assam	26,638,407	78,438	340	35.3	87.3	6,157	36.09	7.4	12.8
Manipur	2,388,634	22,327	107	75.8	76.1	8,745	28.54	2.0	34.4
Meghalaya	2,306,069	22,429	103	69.5	80.4	8,460	33.87	0.5	85.5
Mizoram	891,058	21,081	42	83.0	50.5	—	19.47	0.1	94.8
Nagaland	1,988,636	16,579	120	80.5	82.3	8,726	23.67	..	87.7
Sikkim	540,493	7,096	76	45.0	88.9	9,816	36.55	5.9	22.4
Tripura	3,191,168	10,486	304	67.4	83.0	6,813	34.44	16.4	31.0
Total	39,035,582	262,179	149	64.6	85.0	6,625	34.28	6.6	27.2
India	1,027,015,247	3,065,027	324	20.6	72.2	10,254	26.10	16.3	8.0

— Not available.
 .. Zero or insignificant.
 Source: www.indiastat.com.

Water

- 1.8 The water resources of the Northeast are abundant and constitute one third of all of India's runoff. In addition, there are substantial unutilized groundwater resources.
- 1.9 Appropriate water development and management can provide several benefits:
- **Income generation** to the northeastern states through development of the massive hydropower potential of the region (with the host state getting large royalties of 12 percent of generated power, which could be sold in the market).
 - **Improvement of the base conditions** for development in the Northeast, for instance through:
 - Making hydropower available for industrial development and local electrification
 - Catchment area treatment around dams to control deforestation and erosion, which otherwise lead to increased siltation of dams, thus reducing their useful life
 - Flood and erosion control, thus improving the livelihoods of farmers in the flood-prone areas
 - Watershed management activities in major watersheds to improve livelihoods, prevent erosion and landslides, and conserve biodiversity
 - Groundwater development, especially for expanded winter and spring agriculture
 - Wetland preservation and management to improve rural livelihoods, and for biodiversity conservation
 - Inland water transportation to reach internal and export markets.
 - **Cooperation on water and power with neighboring states** can be a pillar for the regional cooperation and development strategy of the Government of India.
 - **Development of sustainable hydropower can contribute to reductions in greenhouse gases**, a global benefit, but also one from which India may be able to benefit as carbon trading mechanisms emerge.

Forests

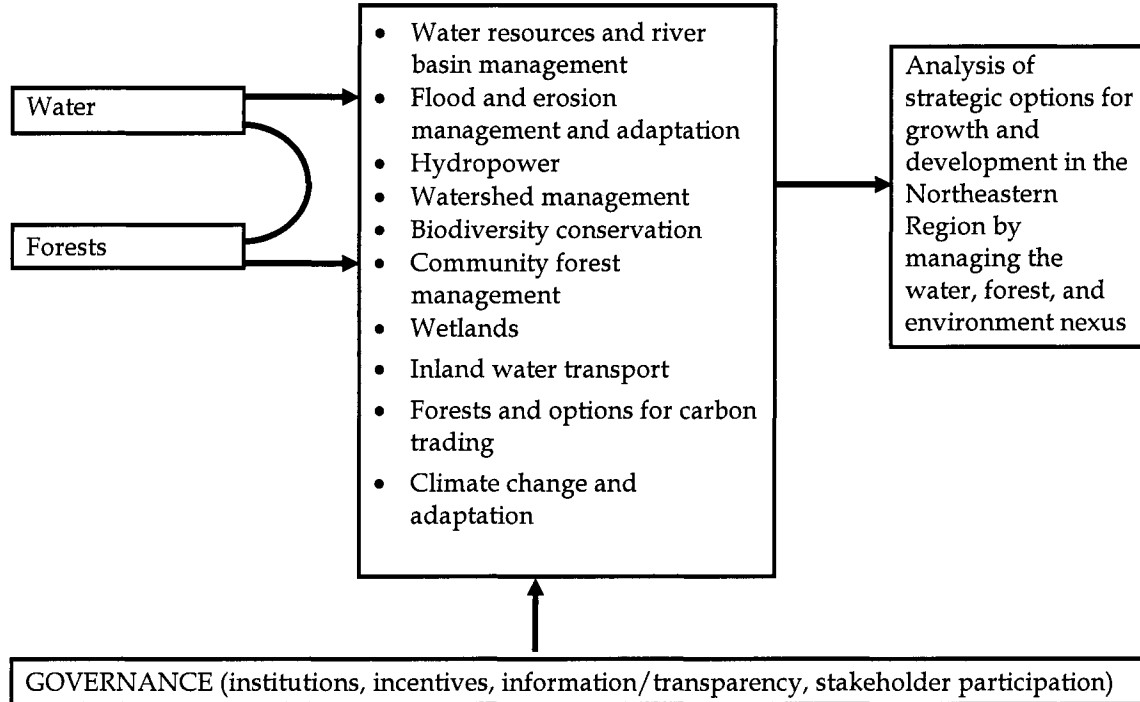
- 1.10 The forests of the Northeast constitute the key livelihood environment for many of the region's inhabitants. The region is at the confluence of the Indo-Malayan and Palearctic biogeographical realms and therefore harbors tremendous biodiversity.
- 1.11 Forest management can provide at least three types of benefits:
- **Improvement of the base conditions** for development in the Northeast through:
 - Maintenance of the forest cover for community-driven productive activities, both industrial and nonindustrial

- Maintenance of the significant biodiversity (flora and fauna) for income-generating activities (for example herbal and medicinal plants, ecotourism) in the short, medium, and long term
 - Watershed management and reforestation to reduce or prevent erosion, and to avoid or mitigate the negative impacts on the water resource base.
 - **Income generation** to the northeastern states: For example, the maintenance of forests as carbon sinks is receiving increasing attention through the expansion of carbon trading opportunities. The relatively well-preserved forests of northeast India could provide an income stream to the northeastern states.
 - **Biodiversity conservation** is a stated goal of the Indian Government. The Northeast has been declared one of the world's biodiversity hotspots by Conservation International. There are global long-term benefits to biodiversity conservation and significant opportunities exist for attracting external funding, such as from the Global Environment Facility (GEF), for biodiversity conservation. With its species richness, the region is likely to have high potential for bioprospecting, which could provide additional income.
- 1.12 **Other environmental issues**, such as water pollution and inadequate water supply and sanitation in the major cities, solid waste issues in these growing urban centers, and localized pollution due to oil and coal mining activities, are all important. However, given that the focus of the study is on all eight states of the Northeast, the limited resources available for this study, and the need to focus attention on the highest priority, most pervasive issues for the region, a decision was made to not address these in this study.

Institutions for resource development and management in the Northeast

- 1.13 The study explores in detail the current institutional structure, and the incentives that affect performance, and outlines options for better aligning institutions with the resource management and development challenges.
- 1.14 Figure 1 illustrates the topics addressed in the study and their interlinkage. Governance – a consequence of institutional design and incentives – is an important issue addressed in this report, transcending all other topics.

Figure 1. Interlinkage of topics addressed in the study



1.15 At the outset it is important to note that there are a series of formidable challenges in making the public institutions that operate in the Northeast more effective developers and managers of water and other natural resources. Among the key issues are:

- The historical and contemporary dependence on national agencies for definition, financing, and often execution of projects in the Northeast and the associated accountability issues. This has led to an erosion of enterprise, autonomy, and accountability.
- An unusually fissured and often uncoordinated administrative structure – by issue and by location – in which there is often unwillingness to accept responsibility and a lack of awareness of actions taking place elsewhere.
- The relative weakness of the private sector in a region where the public sector has played the dominant role in development. Coupled with the dependency syndrome, this means that the government acts with little involvement of either the private sector or communities.
- Several central, unaddressed problems arise from the mismatch between:
 - A single water resource system in the Brahmaputra and Barak basin on the one hand, and the (relatively recent) division of the Northeast into eight states, several small, on the other hand
 - A large asymmetry in the assignment of benefits and costs between upper and lower riparians. For example, Arunachal Pradesh's concerns are development of hydropower and avoidance of resettlement, whereas

Assam's concerns are primarily flood management. Arunachal's preference is for single-purpose run-of-the-river projects, whereas Assam would benefit most from largely multipurpose reservoirs. There is currently little systematic exploration of the tradeoffs and mechanisms for a development program that would take full account of the multiple benefits and costs.

2. Objectives of the study

- 2.1 The **overall objective of the study** is to develop a broad vision for water and natural resource development and management leading to sustainable and equitable economic development and growth in the region. It also seeks to identify options for harmonizing interventions that are being carried out by agencies in the area of water and natural resource development and management. The specific objectives are:
- To identify critical institutional reforms necessary for the more effective development and management of the region's water and natural resources
 - To develop an analytical framework that can help identify and prioritize high-return investments in physical and institutional infrastructure based on an inclusive and participatory approach
 - To create a platform for interaction of the relevant stakeholders, ultimately leading to desired institutional reforms.
- 2.2 In this process the study builds on various commissioned reports that have addressed (and are addressing) some of these issues, but tries to add value by (a) supplementing these (national and regional) perspectives with one drawing on global experience; (b) suggesting options for overcoming the institutional, financial, and other constraints that have hindered progress; and (c) developing a view of a prioritized, sequenced set of realizable development and management actions.
- 2.3 In the course of the study a total of 14 Background Papers were commissioned (see annex 1). This strategy report builds on these Background Papers, the discussions held and feedback received during the study, and a review of the available literature.

3. Process, scope, and audience

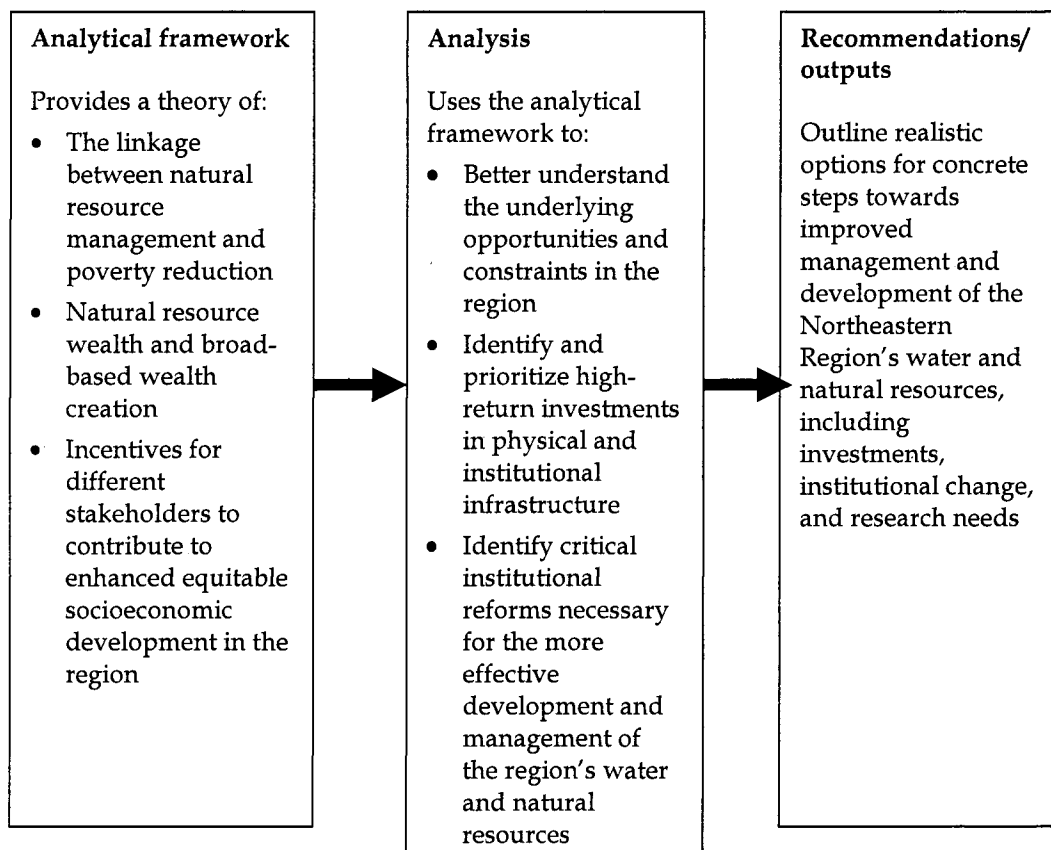
- 3.1 The study has followed a process combining literature reviews, collection of base data, stakeholder workshops and consultations, and discussions with relevant government agencies, NGOs, and expert representatives. It thus relies on a number of methodologies and sources that underpin the analysis and strategic direction outlined in this report.
- 3.2 A central feature of this study has been extensive consultations and discussions with stakeholders, including central and state government officials, academia, experts, and NGOs. Technical discussions, brainstorming, and workshops took place in November 2004 (Delhi, Guwahati, Shillong), January and June 2005 (Delhi), and November 2005 (Guwahati). The draft strategy report, the draft Background Papers, and the November workshop report were then posted on the websites of MoDONER (www.mdoner.gov.in) and the World Bank between February and mid-March 2006. State-level workshops on the findings and recommendations were organized in Arunachal Pradesh (8 May 2006), Assam (24 May 2006), Manipur (15 April 2006), Meghalaya (29 March 2006), Mizoram (May 2006), Nagaland (May 2006), Tripura (May 2006), and Sikkim (24 April 2006). A national-level workshop was held on 26–27 June 2006 in Delhi. This final report incorporates suggestions received during this process, as well as comments received from MoDONER and the Ministry of Water Resources and from various northeastern state governments. It specifically highlights the need to ensure that any developmental activities benefit local people in the Northeastern Region, an issue that was consistently raised in all stakeholder consultations.
- 3.3 Annex 2 presents in detail the different study steps that have been undertaken.
- 3.4 The Northeastern Region is socially, culturally, and politically very complex and contains great environmental and natural resource diversity. It therefore needs to be pointed out that although this study draws on all of the above sources it is not comprehensive, and can only make a contribution to the ongoing development discussions in the region.
- 3.5 Notably, the **scope** of the study with its focus on water and forests was defined based on initial discussions with a variety of stakeholders and on the important role that these natural resources could play in furthering development in the Northeastern Region. The study, by design, thus deals with the larger systemic issues and does not deal with services (such as water supply) or with environmental pollution issues, which are also important but could not be addressed at this stage. It also needs to be pointed out that the significant data limitations, both on the water resources and the forest and biodiversity sides, have restricted some of the analysis. As outlined in the report, filling the knowledge gaps and increasing public accessibility to available knowledge and data would be an important next step for the Northeastern Region in strengthening its basis for inclusive and participatory approaches to regional growth and development.
- 3.6 The **audience** for this report are the central and state government agencies concerned with the Northeastern Region as well as the numerous NGOs, donor and financing agencies, corporations, academics, and any other engaged citizens of the region. The aim of this document is to suggest strategies to harness the region's wealth in ways that promote consensus and a shared vision for growth and development. Many

development options relating to water involve balancing conflicting interests and are, therefore, inherently difficult, often emotive, and prone to discord. This report contends that appropriately designed institutions can facilitate the development process by creating win-win situations that facilitate consensus even when such tradeoffs are involved.

4. Analytical framework

- 4.1 To attain the objective of the present study, namely to develop a broad vision for water and natural resource development and management leading to sustainable and equitable economic development in the region, an analytical framework is necessary to help identify and prioritize high-return investments in physical and institutional infrastructure.
- 4.2 Figure 2 illustrates the role of the analytical framework and its link with the outputs of the study.

Figure 2. Analytical framework and link with outputs



- 4.3 Construction of the analytical framework draws on three approaches: development economics; institutional economics; and current theories about natural resource management, including water resource management. All three approaches strongly emphasize the need for functioning and accountable institutions.

Development economics

- 4.4 Economies richly endowed with valuable natural resources have a comparative advantage over their resource-poor counterparts and should, therefore, be more prosperous. Indeed for many centuries people moved to and colonized areas where natural resources were abundant – the Americas, Australia, the Middle East, and India. But there are innumerable recent counterexamples where resource wealth has failed to generate growth and development. For instance, minerals have not made Angola, Papua New Guinea, or Sierra Leone rich. Most of India's lagging states (Orissa, Bihar, and Jharkhand) are mineral dependent. Venezuela and Nigeria have not prospered from their oil windfalls, and forest-rich countries such as Congo, Ghana, and Surinam remain among the poorest in the world. There is a robust statistical relationship that shows that, on average, resource-dependent economies perform poorly in terms of economic growth and development – a result so ubiquitous in developing countries that it has been termed the "resource curse".
- 4.5 Why does natural resource dependence impede growth and development? There are several reasons why this occurs, but there is broad consensus that weak governance is at the root of the problem. The concentrated rents (benefits) accruing from natural resources influence the kind of institutions that evolve. The prospect of large and rapid gains from natural wealth tends to reorient administrative priorities from concerns about the size of the pie (growth), to concerns about the share of the pie (distribution). **Development economics** tells us that in natural resource-dependent countries and regions institutional erosion and conflict are closely linked, unless they are accompanied by complementary institutions and policies. Hence, resource wealth in countries with strong and accountable institutions has generated virtuous outcomes (for example in Australia, Botswana, Canada, Malaysia, and the United States of America). But where institutions are weak (for example in Angola, Chad, and Papua New Guinea) resource dependence has weakened the rule of law and generated conflict, and is associated with slow development. The overall message from development economics is that institutional strengthening and reform must be at the center of any resource-intensive growth strategy.
- 4.6 Accordingly, India's Northeastern Region could be seen as a victim of a low-level equilibrium where poverty and lack of development (compared with the remainder of India and other Southeast Asian nations) lead to civil conflict, lack of belief in political leadership and government, and, therefore, to a politically unstable situation. This in turn leads to further barriers to poverty reduction, accelerated development and growth.

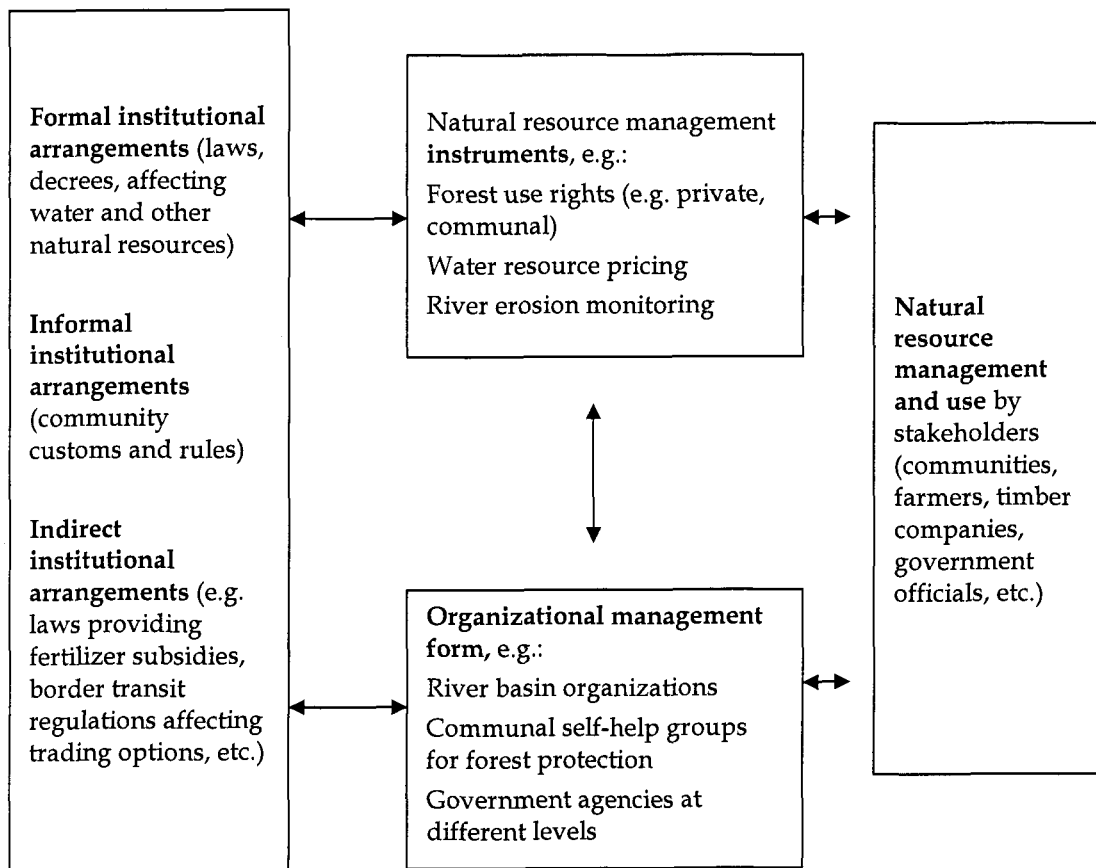
Institutional economics

- 4.7 The way to deal with this vicious circle would thus be to address the institutional setup and change stakeholders' incentives. In order to analyze institutions one needs to define and understand them. This is referred to by institutional economists who define institutions – or institutional arrangements – as the "rules of the game" within which stakeholders act (North 1990). Institutional arrangements include formal laws and regulations, informal norms, and organizations. In the context of natural resources such arrangements might include national or state water, forestry, land, and irrigation laws and their regulations and decrees, as well as norms developed and applied in

communities regarding natural resource use (see for example Background Paper 12 by Poffenberger and others detailing the community rules in Nagaland related to the *jhum* agricultural system). These norms may be written or informal.

- 4.8 Institutional arrangements also determine which agencies exist (for example the Brahmaputra Board, state electricity boards, community councils) and at which levels (national, state, local, and so on), and which instruments are available to guide and manage natural resource use. All these ingredients define the institutional framework that affects stakeholders' decisionmaking. Figure 3 provides a summary of these interactions.

Figure 3. Summary of interactions defining institutional framework



- 4.9 Institutions are thus central as the primary agents of development. Institutional analysis involves consideration of the key elements of incentives, transaction costs, and path dependence, which will be applied in this study.

Incentives

- 4.10 Human beings react to incentives. If a resource is abundant and cheap, economic actors will use it. If a resource is owned by a large group of people and this group does not set rules on how to use the resource (be it forests or water), then it becomes an “open access” resource, which may lead to overexploitation. On the other hand, if the group of people join together and enforce management rules, for instance by applying peer pressure within the community, or by enforcing sanctions against disruptive behavior, then the incentives for management of the resource change. Accordingly, the message emanating from institutional economics is that incentives need to be crafted in such a way that they encourage the improved use and management of a certain resource. In subsequent sections, this report analyzes how the incentives in the water and forest sectors operate and how they could be changed to lead to better results.
- 4.11 Incentives also determine the way in which institutions and the administration function and respond to their clients. A large body of literature demonstrates the “primacy of institutions” in explaining the large divergences in development experience. Public institutions are responsible for investing in infrastructure, regulating markets and their externalities, providing rule of law, managing conflict, stabilizing the macroeconomy, and providing social insurance. Without good institutions not only is development impeded but exploitation of natural resources can harm the environment and provide little in the way of public benefits. If accountability to stakeholders is low, or the system is shrouded in opaque rules and procedures, there is little incentive for administrators to respond to public needs. The implication for the Northeast is that the level of institutional accountability will play a key role in defining the contours of development.

Transaction costs

- 4.12 Transaction costs are those financial, political, or time costs incurred due to existing institutional arrangements. The concept is important because even excellent laws, rules, and regulations will not make a difference if they are unenforceable or unworkable, perhaps because the strong policing required is not available or because stakeholders effectively do not agree with them and do not want to comply. Then the transaction costs might be too high for the institutional framework to function properly, even though it may seem in theory to be well structured.
- 4.13 Moral hazard and corruption can increase transaction costs if lack of enforcement or sanctions reduces the incentive to act honestly and allows actors to shirk their responsibilities. In such circumstances the credibility of the institutional framework may be strongly impaired and it will be difficult to work towards equity and growth for the wider population.

Path dependence

- 4.14 Path dependence is the tendency of a community or region to continue along the path it is already following. Such factors as the history of a region, its politics, and the current state of education, poverty, and health have set the region on a certain path, which needs to be taken into account in any analysis. It is possible to deviate from a given path, escaping, for example, from the vicious circle of poverty and low-level development (see

paragraph 4.5 above), but in crafting improved institutions the transaction costs involved in changing the existing situation have to be considered.

- 4.15 The above concepts will be used in the analysis of the different sectors covered in this study and in the recommendations for a way forward.

Water and natural resource management approaches

- 4.16 Over the past decades a significant body of knowledge has been created on natural resource management in general and water resource management in particular, based on experiences worldwide with successful and unsuccessful approaches. Incentives have been found to play an essential role in the development of improved management.
- 4.17 In many countries natural resources are an open access resource, in that there is no perceived owner of the resource, other than perhaps the state. This is often the case for rivers (whoever gets to it first can withdraw water), groundwater (whoever has access to the overlying land can pump the water), forests (whoever wants to cut down trees can do so), and also oceans (whoever has the fishing vessels to fish can do so). In all these cases, if there are too many people doing the same thing, the carrying capacity of the resource may be insufficient and the resource may degrade, to the benefit of a few while it lasts, but to the detriment of all in the long term.
- 4.18 It has also been found, however, that different types of ownership can stave off the above negative trend. In India's Northeast, notably, there is a range of states where tribal communities have traditionally been very strong in managing their forests. This coincides with the general call in the natural resource literature for providing management responsibilities to those actors "at the lowest appropriate level", whereby resources are managed by those who can do so most effectively, rather than by distant bureaucrats.
- 4.19 This is particularly the case for river basin management approaches, where decentralization of decisionmaking is strongly advocated in order to provide incentives for those stakeholders who are the closest to the resource to manage it better. In the case of the Northeast, this would certainly lead to an examination of the history of managing the Brahmaputra and Barak river basins through a central agency, such as the Brahmaputra Board, compared with an organization that would be more grounded in the northeastern states and would operate with their full and active participation. Such an organizational structure would be expected to provide more incentives for effective use, development, and management of the river.
- 4.20 A further central concept in water and natural resource management is benefit sharing. Infrastructure development – particularly in the water sector – creates both winners and losers. The benefits of dams and other hydrological infrastructure typically accrue downstream whereas the costs of inundation and construction activities are borne upstream. There are at least four reasons why generating broad-based growth requires that attention be paid to the distribution of losses and gains.
- 4.21 First, as the Nobel laureate Amartya Sen has forcefully argued, development involves more than a singular concern for aggregate macroeconomic statistics (such as gross domestic product). It requires attention to other elements of well-being such as economic opportunities, education, and health. This implies that it is not only desirable to protect

the poor and the vulnerable from adverse shocks that they suffer as the country seeks to build its infrastructure, but to ensure that they too are able to reap the benefits from such infrastructure development.

- 4.22 Second, to sustain an economically efficient development trajectory it is necessary to address the economic, social, and environmental externalities created by large development projects and other economic activities. These impose costs on the economy that can impede growth and constrain development. For instance, deforestation, overgrazing pastures, polluting rivers, mining fertile soils, and depleting groundwater will generate immediate gains, but will also reduce the productivity of economically valuable natural assets. Addressing these environmental issues may be costly. However, these costs need to be compared to the benefits of prudent and sustainable management of natural assets.²
- 4.23 The third reason is entirely pragmatic. Public resistance to projects has been fueled by widely held perceptions that compensation to losers is inadequate, insufficient, and uncertain. To promote support for these “footprint” projects it is advisable to address these concerns and pay careful attention to negative impacts.
- 4.24 Finally, when growth is generated through broad-based development of the manufacturing and service sectors, there is little reason to introduce benefit-sharing policies. Job creation ensures that the general benefits of broad-based growth will eventually percolate through the economy. But some enclave industries either have small multipliers or low poverty elasticity, implying that few of the benefits flow through the economy. This is true of those developments that are (a) capital intensive and employ few people; and (b) create large and concentrated rents for those who control the resource. To induce broad-based growth (particularly upstream among the probable losers) there is an obvious economic imperative to share the captive rents from these developments.
- 4.25 In the following sections, the findings of the study will be presented with regard to its key themes. These are summaries based on the Background Papers, the discussions held with the different stakeholders, and the literature reviews undertaken. The subsequent section will analyze these findings by applying the analytical framework, which will help us answer the following questions:
- What are the challenges facing the region, given the current stakeholders, their incentives, and the institutional framework?
 - Which activities in the areas under study should receive priority?

² There is a widely held view that in poor economies it is necessary to neglect social and environmental externalities to accelerate growth and development. This has gained support from an empirical result termed the environmental Kuznets curve, which showed that eventually certain pollutants may decline as income rises. The policy implication drawn by some is that it is optimal to neglect environmental issues until this level of development is reached. But this is an empirical prescription without analytical foundation and it ignores the economic costs of degradation. In many cases prevention or mitigation of damage may be more cost effective than neglect. In short, economic prudence does not endorse environmental profligacy but requires that the costs of degrading the environment should be compared to the benefits of protecting these assets.

- What key institutional reforms would have to take place for priority actions to be effective and, given the political economy, what is the likelihood that they will come to pass?
 - What outcomes could be expected from the above?
- 4.26 Before turning to the sectors, the broad development path of the Northeast up to the present will be analyzed.

5. Path dependence in the Northeast: Why history matters

The history of the Northeastern Region: An exercise in historical accidents?

- 5.1 Northeast India was at one time a great crossroads linking the Indian subcontinent with East, Southeast, and Inner Asia along the southern Silk Route. Commerce, culture, and faith traveled that route and migrant streams moved into this sparsely populated but richly endowed region from central China and Southeast Asia.
- 5.2 Tea plantations were established and oil was discovered in Assam in the late 19th century and by the early 20th century the province was among the more prosperous and globalized parts of India. Steamships moved along the bustling Brahmaputra and Barak waterways to Calcutta carrying Assam tea to London auctions. Coal was mined and Digboi still boasts the oldest producing oil well and refinery in the world. In 1873 the British drew an Inner Line along the foothills skirting the Brahmaputra and Barak valleys to protect them from the marauding tribesmen who would periodically descend from the surrounding mountain and jungle. The outer limit of the hill country marked the political frontier whereas the Inner Line marked the administrative boundary. The lands in between were “excluded areas”, directly ruled by the governor of Assam, whose authority extended to the two princely states of Manipur and Tripura.
- 5.3 The Northeast was a major staging area for the Allied armies and air force for the Burma and China campaigns during World War II. The advance by the Indian National Army (supported by the Japanese) was halted at Kohima and on the outskirts of the Imphal valley. Independence followed in 1947. Many of those making up this extraordinary mosaic of ethnic, linguistic, and cultural diversity were uneasy to find themselves members of a new nation state. The ensuing political, cultural, and economic uncertainty has been the precursor to much of the region’s current unrest.
- 5.4 Partition and a time of trouble across the international boundaries in Bangladesh (then called East Pakistan), Tibet (then independent), and Myanmar traumatized the region further. Lands were sundered, lives and livelihoods were disrupted, and arteries of communication were cut. The only link to India was the circuitous Siliguri corridor, the so-called Chicken’s Neck, a narrow wedge of territory between Nepal and Bangladesh. Market disruption shattered local economies and heightened the Northeast’s geopolitical and cultural isolation.
- 5.5 Sikkim (a former protectorate, fully acceded to India in 1975) was formally added to the Northeast recently as the eighth member of the North Eastern Council. But it is geographically separated from the original so-called Seven Sisters. Logically North Bengal is geopolitically part of the Northeast and was recently invited to join it for planning and developmental purposes without injury to its parental West Bengal connection. Politics intervened: West Bengal feared that this might be but the first step towards North Bengal’s separation from the state.
- 5.6 The Northeast is a transition zone. Its position at the confluence of major biogeographical realms has already been noted. Consequently it is home to a wide range of endemic and exotic species and unique gene pools, a treasure house of biodiversity. It

includes the highest rainfall region in the world and exhibits very dynamic tectonics, factors that account for the huge sediment load carried down the Brahmaputra-Barak system, a product of mass wasting and erosion, aggravated by the extensive practice of jhum or slash-and-burn farming in the hills.

- 5.7 With 26 million inhabitants out of the Northeast's 39 million, and also in terms of area, Assam is the largest unit and physical backbone of the region, connecting the other states and joining them with the Siliguri corridor. The major plains areas lie in the Brahmaputra and Barak valleys in Assam, the Imphal valley in Manipur, and the piedmont strip skirting the entire length of western Tripura. Over 64 percent of the land area is forested, ranging from over 80 percent in Mizoram and Arunachal Pradesh to 35–45 percent in Assam and Sikkim. Jhumming (shifting cultivation) is widely practiced in the hills and a steadily shrinking jhum cycle has resulted in degradation, a growing area of abandoned jhum fields, and soil erosion. Urbanization is well below the national average, except in Mizoram. The regional per capita income in 2001 at Rs. 6,625 was below the national average (Rs. 10,254),³ with 34.3 percent of the population living below the poverty line compared to the national average of 26.1 percent (1999–2000).⁴ This is an index of prevailing poverty amidst potential plenty.⁵
- 5.8 Irrigated cropping is practiced in about 30 percent of the plain areas, though the Angami Nagas have beautifully terraced fields, as do the Apa Tanis in Arunachal Pradesh's tiny Ziro valley. Terracing is also found in Sikkim. The Brahmaputra and Barak valleys in Assam have an abundance of water, but recurring floods and limited agrarian reforms have made for agricultural instability. Irrigation is limited and groundwater development is low. Shortage of funds is not the problem as the region suffers from an adverse credit:deposit ratio (Verghese 2006, Background Paper 1).

Overview of current situation

- 5.9 Visiting the Northeast today, a casual observer would be struck by four paradoxical features in the region:
- **Observation 1: Natural wealth.** The region is probably the country's richest in terms of natural resources – with an immense endowment of water, forests, biodiversity, and minerals – yet it remains poor and lags behind the rest of the country.
 - **Observation 2: Public sector dominance.** The public sector is the principal resource manager and the employer of first and last resort. Despite this, service delivery is weak and there has been a failure to convert resource wealth into development benefits.

³ Note that the per capita income in Arunachal Pradesh, Mizoram, and Nagaland was higher than the national average until 1996–1997. Net domestic product and per capita income in these states have reduced significantly after the closure of commercial logging operations and forest-depleting industries.

⁴ Conversion: 1 US dollar = 44 Indian rupees (February 2006).

⁵ Among the northeastern states, Assam and Tripura have very low per capita income (around 65 percent of national average). The other states are relatively better off (at about 80–85 percent of national average per capita income). Poverty incidence in Mizoram and Nagaland is below the national average.

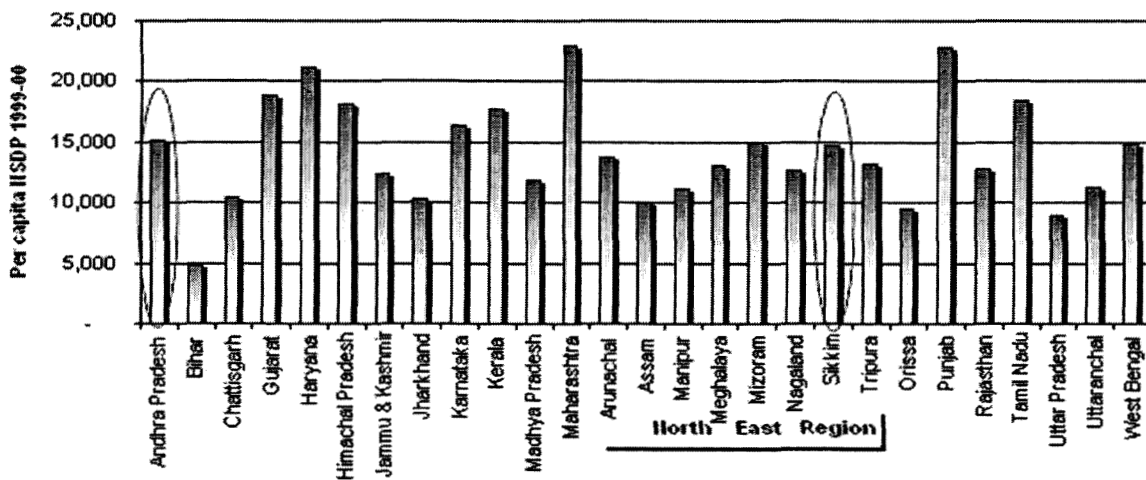
- **Observation 3: Geography is economic destiny.** Low connectivity with the rest of India (through the Siliguri corridor), coupled with a high vulnerability to floods and natural disasters, places the region at a clear economic disadvantage.
 - **Observation 4: Conflict.** Civil strife and conflicts between and within states are common. Many of these have sociopolitical roots but others have their origins in economic differences.
- 5.10 This report starts with the premise that economic growth and development are the prerequisites to reducing poverty and bringing greater harmony to the region. The focus is on identifying ways in which natural resources can be harnessed to bring development and support a peaceful process of growth for the Northeastern Region. This is not to deny the importance of other sectors in unleashing development. The limited focus on water and forests recognizes their development potential and the centrality of these resources in generating growth. Ultimately development of the region involves strategic choices and tradeoffs in managing the portfolio of assets. The aim of this report is to highlight these issues, identify some of the binding constraints on development, and suggest pragmatic solutions.

The economy of the Northeastern Region

- 5.11 Before addressing these issues it is instructive to assess the overall economic performance of the region. This section aims to identify the binding constraints on economic activity, with a focus on the resource sectors. There are many other policy areas that require attention, such as fiscal issues, labor market reforms, and the financial sector, but these lie beyond the scope of this report. Moreover, many issues discussed in the report apply to these sectors, most notably the discussion of institutional reforms.
- 5.12 Figures 4a and 4b present the per capita state domestic product and poverty rates (1999–2000) across the country. The average per capita incomes within the Northeastern Region vary significantly. Sikkim and Mizoram have per capita incomes comparable to a number of states outside the region, whereas Assam is among the states with the lowest per capita income in the country. Comparing figures 4a and 4b, a number of striking features emerge. Overall, the Northeastern Region has higher incidences of poverty, even when compared with states having similar average per capita income. Sikkim and Andhra Pradesh have similar levels of per capita income, but 37 percent of people in Sikkim live below the poverty line, compared to 16 percent in Andhra Pradesh. Rajasthan's per capita income is lower than Meghalaya, but Rajasthan has much lower incidence of poverty (15 percent compared to Meghalaya's 34 percent). Within the Northeastern Region, Mizoram's per capita income is comparable to Arunachal Pradesh's or Sikkim's, but the poverty rate is around half that of those states. Mizoram is the only northeastern state comparable to the best in the country in terms of poverty reduction. With levels of employment in the public sector comparable to some other states in the region, the relatively low poverty rates in Mizoram reflect its sparse population, urbanization, and the high productivity of the natural resource base. On the other hand the disparity between the per capita income and relative poverty rankings of Sikkim and Mizoram suggests that there may be distributional concerns that are likely to be structural and related to geographical difficulties and the type of economic activity in the state.

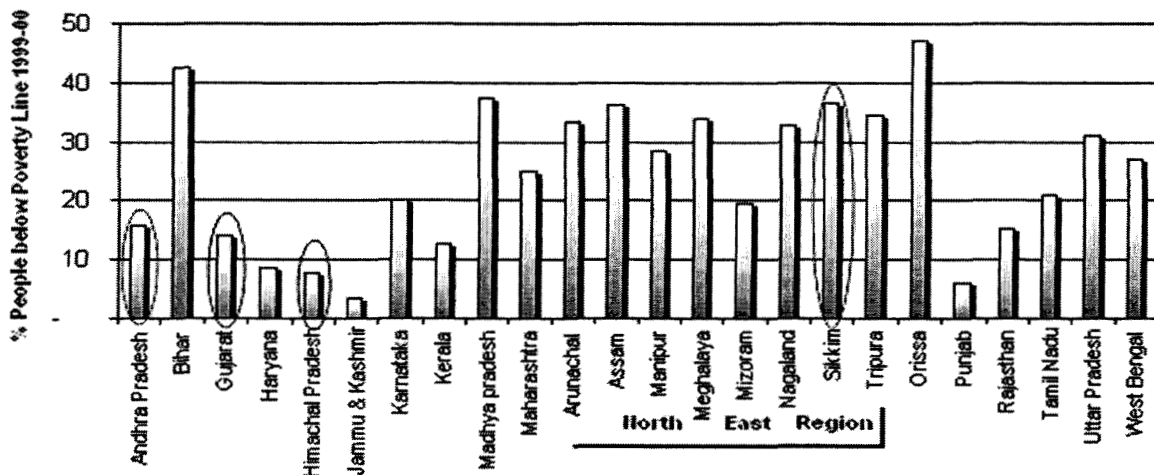
- 5.13 It also needs to be pointed out that in most states of the Northeastern Region, the share of administration in the state budgets is very high. Only in Assam is it low, which is to be expected, because the state has the largest population base and overall administration costs are similar to other big states in India. Data show that for Arunachal Pradesh, a third of net state domestic product (NSDP) comes from the primary sector, and 15 percent from public administration; half of Arunachal's NSDP is therefore due to these two budget items. Also in Mizoram, the primary sector and public administration combined constitute half of NSDP. The high share of administrative budget explains why forestry and mining look relatively smaller than they really are. In Assam, on the other hand, with public administration a much smaller share, the primary sector alone constitutes half of NSDP. This highlights the centrality of natural resources in sustaining economic activity in the region.

Figure 4a. India: Per capita domestic product by state



Source: www.indiastat.com

Figure 4b. India: Percentage of population below poverty line by state



Source: www.indiastat.com

- 5.14 In general, growth in the Northeastern Region is slower than that of the rest of the country and this is reflected in the average per capita income of the region, which is approximately 30 percent lower than the national average⁶ (Assam and Manipur being the lowest, and the other hill states being relatively better – comparable to Andhra Pradesh or West Bengal). Other macroeconomic indicators suggest a region that has missed out on the growth acceleration witnessed throughout much of the rest of India.
- 5.15 To identify why the Northeast lags behind the rest of India, it is instructive to examine the region's economic structure. As in the rest of India the population of the Northeast is predominantly rural, hence the fortunes of agriculture play a key role in determining poverty levels. There are, however, important differences. In most of India's rapidly growing states the agricultural sector is in relative decline, with growth in the service and manufacturing sectors accelerating. However, in the Northeast there is little evidence of economic diversification. Agriculture remains the backbone of the economy and is dominated in the hill states by jhumming. With declining land productivity, it is natural to ask if the region can generate growth by capitalizing on its other natural resources, such as minerals, hydropower, and forests.
- 5.16 This section of the report now looks more closely at some salient features of the economy of the Northeast in the context of the four observations made in paragraph 5.9.

Natural wealth and the resource curse

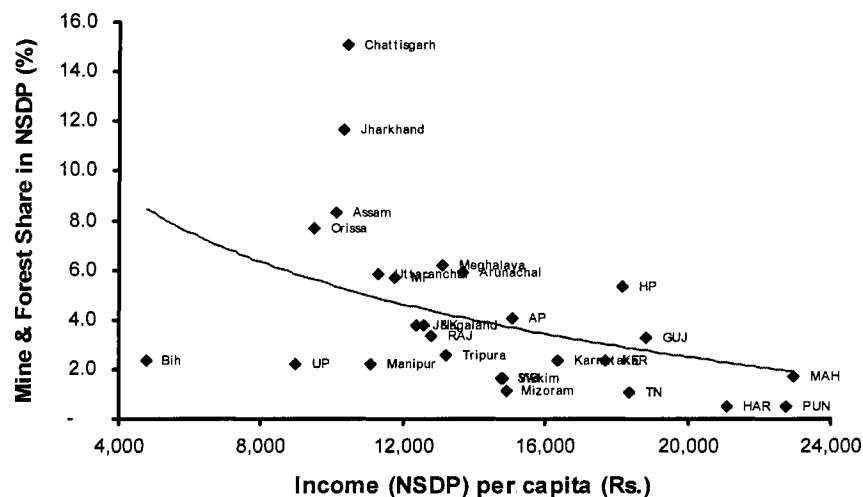
- 5.17 Figure 5 provides a simple plot of per capita state income and the share of mineral and forest production in state gross domestic product. Two broad clusters of states emerge. There are states such as Assam, Chhattisgarh, Jharkhand, and Orissa, which have a high level of dependence on natural resources (minerals and forests), but lower per capita incomes. The other cluster contains the growth successes such as Punjab, Haryana, Maharashtra, Tamil Nadu, and Gujarat, which have low levels of resource dependence and higher per capita incomes. Other measures of development produce an identical pattern – the resource-dependent states have consistently poorer human development index scores, lower growth rates, and higher levels of infant mortality.
- 5.18 But there are also some notable anomalies. Gujarat and Rajasthan have similar levels of resource dependence yet Gujarat's per capita income (gross domestic product) is almost twice that of Rajasthan. The reason for this divergence is that Gujarat, with its larger manufacturing base and service sector, can generate jobs, growth, and income.
- 5.19 This outcome is not unique to India and, as mentioned in paragraph 4.4, is termed the resource curse. On balance the evidence indicates that in most countries a high level of resource dependence is associated with slow economic performance and poor development outcomes. In particular countries that are dependent on point resources – resources extracted from a narrow geographic base, such as minerals – perform poorly across a range of development indicators. The evidence shows that point resources (which include plantations, minerals, and dams) have relatively low employment

⁶ This is also due to the heavy weight of Assam in the overall population of the Northeast.

multipliers and, therefore, generate few jobs. In countries where the resource sector has led growth, it has done so by catalyzing broad-based development across the economy. In some countries this has occurred through the development of upstream industries – industries that supply equipment. California’s mineral boom in the 1880s spawned a high-tech industry specializing in the supply of mining equipment. In countries such as Finland, with its forest-dependent economy, the focus has been on creating niche markets. The globally renowned Finnish firm Nokia started as a logging company, but is now famous for its mobile phones.

- 5.20 But experience has shown that such linkages can be difficult to secure. There is an established body of hard evidence indicating that institutions are among the key drivers of growth and development. However, most resource-rich countries tend to have weak institutions. The concentrated rents from point resources are a compelling target for rent seeking. This distracts policy priorities from concerns about growth and development to concerns about allocating rents from resource extraction. Hence resource wealth is associated with fragile institutions that create distorted development patterns where the benefits are captured in enclaves, but the social and environmental costs are borne in the rest of the economy.
- 5.21 If resource dependence retards growth, should the Northeastern Region turn its back on its comparative advantage and diversify into other sectors? The experience of numerous countries shows that slow growth is neither an inevitable nor unavoidable consequence of mineral wealth. Countries such as Australia, Botswana, Canada, Chile, Norway, and the United States have successfully harnessed their mineral wealth to build modern, productive economies. These examples demonstrate that it is not the wealth of resources but the way in which their exploitation is accommodated into a wider process of development that determines economic success. In India, as elsewhere, economic progress is shaped by policies and institutions. The conclusion is that resource-led growth must be accompanied by institutional reforms and policies that are conducive to broad-based development.

Figure 5. India: Mineral and forest share and per capita income by state



Source: www.indiastat.com

Public sector dominance

- 5.22 The public sector is the principal resource manager and the employer of first and last resort in the region. The public sector is large and is mainly funded by the central government. All states in the Northeast are classified as “special category” jurisdictions, which implies that 90 percent of transfers are through grants and 10 percent through loans. In the other states the ratio is 30 to 70 percent.
- 5.23 Despite relatively large plan allocations (as per Finance Commission norms), the region is also plagued by large fiscal deficits and poor infrastructure. Figure 6 shows the infrastructure index presented in the Twelfth Finance Commission Report (Government of India 2004), which ranks all states of the Northeast in the lowest category for access to physical infrastructure. To some extent this may reflect the higher costs of constructing and maintaining assets in one of the remoter parts of the country, but simply increasing budget outlays may not be the solution if the binding constraints on performance lie elsewhere.

Figure 6. Finance Commission ranking of infrastructure

High	Goa, Maharashtra, Punjab
High middle	Gujarat, Haryana, Kerala, Tamil Nadu
Middle	Andhra Pradesh, Karnataka
Lower middle	Himachal Pradesh, Madhya Pradesh, Orissa, Uttar Pradesh, Uttaranchal, West Bengal
Low	Arunachal Pradesh, Manipur, Meghalaya, Jharkhand, Mizoram, Nagaland, Assam, Chhattisgarh, Sikkim, Tripura, Jammu and Kashmir, Bihar, Rajasthan

- 5.24 What might explain the weak performance of the public sector? In answering this question it is tempting to focus on the more visible challenges, such as lack of funding, state deficits, overlapping mandates between institutions, and legal ambiguities. These are all valid areas of concern but are also relatively easy to remedy, either through administrative decree or further fiscal transfers from the Centre. However, increased funding in the past appears to have done little to improve service quality. The reason, as suggested by institutional economics, is that accountability

“New patterns of development need to be structured. There are examples of innovation: Nagaland’s village development boards with their common fund and the Nagaland environmental protection and economic development (NEPED) program for introducing upgraded tree farming into the jhum cycle as a starting point for tapping its considerable biodiversity, Meghalaya’s groping towards a new concept of ‘tribal interest’ for acquiring land, as well as its Economic Development Council and plans for reorganizing its electricity board, Mizoram’s new land use policy, Tripura’s smallholder rubber plantations, and Assam’s experiments with apex councils and proposals for reinvestment of agricultural income tax by assesseees for approved purposes.” (Shukla Commission Report, 1997)

remains the key determinant of institutional performance. This is also one of the issues addressed in *Yojana* (Planning Commission 2005), which includes frank articles by members of the Planning Commission.

- 5.25 The colonial antecedents of institutions in the Northeast emphasized top-down approaches to accountability. As a consequence public sector goals are defined in terms of measurable physical outputs, such as the length of embankments or the number of schools built, rather than in terms of the end product, for example the level of protection from floods or the quality of education. This is understandable, since outputs such as services are harder to measure than physical inputs. But the result is that there is often little correlation between the tangible physical inputs and the intangible outputs (services). Since consumers (citizens) have no formal role to play in the process, there is no mechanism for identifying policy failures and the many challenges that prevent the line departments from fulfilling their mandates. This suggests the need to focus on bottom-up approaches to service delivery and governance to improve accountability and information flows between the consumers of public services (citizens) and the providers (institutions). The precise ingredients of the reform initiatives will vary by sector, and the focus in the following chapters is on developing high-impact reforms in the water and natural resource sectors and proposing mechanisms that address resource conflicts and sustain growth.

Geography is economic destiny

- 5.26 Low connectivity with the rest of India (through the Siliguri corridor) is perhaps the greatest economic impediment in the region. With limited geographic access to markets the region is at a comparative disadvantage in its ability to attract investment. Even after the proposed development of the East-West National Highway corridor (or in the long term, the Asian Highway), there seems little prospect of improving road access through routes within the national boundaries.⁷ Further development of inland water transport offers a partial remedy.⁸ Other ways of overcoming these geographical constraints include developing niche markets in commodities with a high value-to-bulk ratio, promoting electricity-intensive manufacturing⁹ and industries that are less affected by bottlenecks in road transport, such as ecotourism.

Conflict

- 5.27 Civil strife, together with conflicts between and within states, is common in the region and remains a significant constraint on development. Differences in culture, tribal links, and political aspirations are one set of explanations for the current unrest in the region. But there is much global evidence that poverty, competition for limited resources, and underdevelopment are major catalysts of conflict. Poverty and other economic factors

⁷ Possibilities exist, however, depending on the progress of recent Government of India initiatives such as the Look East Policy, which suggests opening up trade with the countries of the Association of Southeast Asian Nations (ASEAN) through India's Northeastern Region.

⁸ In the case of Sikkim and Arunachal Pradesh improved air connectivity would be essential. However, air connectivity is not within the scope of this report.

⁹ The potential for attracting power-intensive manufacturing industries is based on creating opportunities for supplying reliable, assured, and comparatively cheaper power (mostly hydropower).

are seldom the direct causes of conflict but they can aggravate existing tensions, tipping the balance towards conflict rather than a search for negotiated peaceful solutions.

- 5.28 Research finds that resource-dependent economies are more vulnerable to conflict, unrest, and civil strife. The dilemma for resource-rich economies is that development and growth are often necessary prerequisites for addressing grievances. But the pursuit of growth through resource-intensive development also creates losers and thus promotes conflict. The remedy suggested in this report lies in policies and institutional reforms that explicitly identify and address the negative impacts of development.

6. Study findings: Water

- 6.1 In this chapter the focus is on findings of the present study regarding water and the institutional arrangements for managing and developing this essential resource for the sustainable growth and development of the Northeastern Region.
- 6.2 The following sections describe key issues in selected water-related sectors, namely water resource management, inland water transport, flood and erosion management, and hydropower. Each section discusses the historical and current situation with its challenges and opportunities, followed by analysis of how the issue has been addressed over time, with recommendations for new approaches.

Water resources in the Northeastern Region

- 6.3 **Vast capacity.** The Northeastern Region has two major river systems, the Brahmaputra and the Barak, which together cover a large part of the region's territory (Sikkim is part of the Teesta basin, and Manipur and Mizoram include parts of the small basins of the Manipur and the Koladyne). The Brahmaputra is one of the largest river systems in the world, and has 52 major tributaries. The system has a total catchment area of 580,000 square kilometers, 33.6 percent of which (195,000 square kilometers) lies within India; other parts of the system occupy China (50.5 percent), Bangladesh (8.1 percent), and Bhutan (7.8 percent). It has an average annual flow volume of about 600 billion cubic meters,¹⁰ which represents more than 30 percent of the total freshwater resources of India.
- 6.4 The mean annual rainfall averaged over the Northeastern Region is 2,300 millimeters, with up to 5,000 millimeters in some areas. The developed irrigation area is only 41 percent of the ultimate potential, in comparison to 67 percent for India as a whole. Hydropower potential is around 66,000 megawatts, which represents about 40 percent of the national potential, but the operating hydropower projects and projects under construction together constitute 6 percent of the region's potential (compared to the all-India figure of 28 percent). The navigation potential of the main Brahmaputra and Barak rivers and their tributaries has also remained largely undeveloped. On the other hand, the region has major recurrent problems of floods, soil and bank erosion, and drainage congestion due to excess water, particularly in the monsoon season.
- 6.5 **Unstable and untamed.** The Northeastern Region has suffered several major earthquakes in the past, of which those in 1897 and 1950 are rated amongst the severest in the world. The 1897 earthquake seriously disturbed the topography and the drainage system of lower Assam, while the 1950 earthquake severely affected the drainage system of the upper Brahmaputra, causing major morphological changes and a rise in riverbed levels of up to 2 meters, which resulted in increased flooding and erosion. The estimated area eroded since the 1950s is 386,000 hectares, which is about 7 percent of the geographical area of Assam. Heavy runoff from the hills causes flooding in the plains

¹⁰ The average annual flow of the Brahmaputra, at different points over its stretch, ranges from 322 (Dibrugarh), 537 (at Jogighopa), 594 (Guwahati), and to 620 (Bahadurgarh, Bangladesh) billion cubic meters.

year after year, with loss of human lives and livestock and heavy damage to private and public infrastructure. In fact, infrastructure developed in the dry season is often washed away in the floods.

- 6.6 The Brahmaputra and Barak rivers constitute India's National Waterway 2 (NW-2), connecting the Northeast with markets in mainland India, Bangladesh, and Southeast Asia. Their basins house a multitude of species and are also characterized by water bodies such as *beels* (seasonally flooded wetlands), and by abundant groundwater resources (table 2).
- 6.7 Accordingly, the two basins constitute the lifeline of the region, providing great opportunities but posing numerous challenges. Addressing these implies both benefits and costs, which are addressed in the subsections below.

Table 2. Summary of water resources in the Barak and Brahmaputra basins and Northeast India

	Barak basin (Northeast India)	Brahmaputra basin (Northeast India)	Northeast India
Catchment area	41,723 km ²	194,880 km ²	257,329 km ²
Water availability per capita	—	18,400 m ³	16,589 m ³
Water availability per ha	1.16 ha m	—	44,180 m ³
Runoff per capita	7,474 m ³	21,060 m ³	—
Runoff per hectare	56,680 m ³	44,232 m ³	—
Annual surface water potential	585.6 km ³	1,869 km ³ (Central Water Commission)	—
Utilizable surface water (including Ganges and Meghna)	24.0 km ³	690 km ³	—
Annual surface water availability	48 km ³	537 km ³	—
Average annual runoff per ha and per second	53,680 m ³ /ha	19,830 m ³ /second	—
Annual availability of water per hectare of cultivable area	43,447 m ³	44,232 m ³	—
Wetlands			
Area covered by wetlands	13,748 ha	223,704 ha	—
Wetland area usable for storage basins during floods	42 km ²	102 km ²	—
Groundwater			
Groundwater recharge rate	—	—	32 billion m ³
Groundwater potential	—	26.55 km ³ /yr	855 Mm ³
Annual utilizable	1.8 m ³	27.9 m ³	2.76 m ³

	Barak basin (Northeast India)	Brahmaputra basin (Northeast India)	Northeast India
groundwater per ha			
Water demand			
Total water withdrawals	—	9.9 km ³	—
Irrigation	—	8.0 km ³	—
Domestic use	—	1.0 km ³	—
Industrial	—	0.9 km ³	—

— Not available.

Source: Mahanta 2006.

The current knowledge base

- 6.8 Good policies are founded on good information. Accordingly this study commissioned a survey of the knowledge base of the Brahmaputra and Barak basins. Mahanta (2006 – Background Paper 2) surveyed the available information and provided a quantitative assessment of water resources in terms of river flow volumes, wetlands, groundwater, and rainwater harvesting potential in hilly areas. His paper analyzes current and future water demands (including environmental demands) and current levels of utilization.
- 6.9 With advances in the scientific understanding of river ecosystems and long-term river basin-scale processes, new river management approaches are being developed that allow for integration of flood management and water resource development objectives with protection and conservation of the riparian and floodplain ecosystems. In a Background Paper commissioned for this study, Pahuja and Goswami (2006 – Background Paper 3) introduce the fluvial geomorphology approach (also known as the ecological approach) and its applicability to large alluvial river systems like the Brahmaputra. Given, on the one hand, the need for designing sustainable solutions for flood management and water resource development, and, on the other hand, the need to work with the natural dynamics of large-scale and powerful river systems like the Brahmaputra, it is imperative to ensure that management approaches and technical decisionmaking are grounded in a good understanding of the nature of these river systems and the long timescale processes that shape them.
- 6.10 An assessment of the knowledge base regarding water resources in the Brahmaputra and Barak basins shows that there is an appreciable quantity of information. It also shows, however, that there are serious gaps in the data required for analysis, which compromises informed decisionmaking. These gaps include the following:
- There are inadequate data on the hydrometeorology and land use of the upper catchments, sediment loads, and the hydraulic and morphological characteristics of the rivers.
 - While the Central Water Commission has taken some initiative to harmonize data collection, this effort has fallen short of providing an overall systematic framework with a coherent set of objectives.

- Many valuable data are in confidential government reports that are unavailable in the public domain. As a result, there is little (or no) peer review of the knowledge base and no independent analysis of the data. These restrictions on data access need to be reexamined, since earlier reasons for confidentiality have been made irrelevant by technological developments. It is recommended that:
 - Data be declassified where historical rationales for confidentiality no longer apply
 - In cases where access to data needs to be controlled, the information be disaggregated so that insensitive but useful information can be released to the public.
 - No systematic evaluations have been conducted to assess the effectiveness of the investments of the last five decades in flood control infrastructure. A revived flood management strategy needs to be informed by a rational assessment of these investments.
 - The knowledge base is particularly poor in regard to lakes and wetlands, groundwater resources, and environmental water demands. In addition, information pertaining to developments in the upper catchments that result in landslides and glacial floods is sparse.
 - While there has been a revolutionary change in the last two decades in technologies for data collection and analysis, there has not been a commensurate improvement in the knowledge base (with the exception of a few studies based on remote sensing data).
 - From a river systems perspective, project-specific investigations are often incomplete and ineffective without the context provided by the catchment-scale analyses. However, individual projects are generally unable to afford catchment-scale analyses on large rivers like the Brahmaputra. Therefore:
 - Catchment-scale research needs to be coordinated and conducted at regional level.
 - A coherent research program needs to be designed, with clearly specified objectives in terms of data and understanding, and with a series of well-defined tasks to achieve those objectives.
- 6.11 In summary, while much is known about the Northeastern Region's water resources, there are significant gaps in information and in accessibility to existing information. This situation hampers planning and generates a feeling of insecurity in stakeholders. Increasing transparency would strengthen accountability for the various institutions and would augment the knowledge base (for instance, research institutions could develop more relevant research programs if they could freely build upon existing data and analyses).
- 6.12 The following subsection covers institutional arrangements for water resource management and development in the region.

History of institutional arrangements for managing water resources in India and the Northeastern Region

- 6.13 Historically, water resource interventions in India focused on irrigation and power, with flood control as a later consideration. There are a multitude of institutions involved in the management and administration of water resources in the Northeast. At the central level the Ministry of Water Resources was created in 1985 with responsibility for planning and coordinating development of the country's water resources. The National Water Resources Council, chaired by the prime minister, was established in late 1987. Subsequently, the National Water Board was formed to monitor implementation of the National Water Policy. The National Water Resources Council is chaired by the secretary, Ministry of Water Resources, and members include the chief secretaries of all the states and union territories, secretaries of the concerned union ministers, and the chair of the Central Water Commission. In 2002, a revised National Water Policy (Government of India 2002) was adopted by the National Water Resources Council and another task force was formed to study the interlinking of rivers.
- 6.14 Legally, water resource management and development is under state authority, in accordance with the Constitution (Entry 17, List II). However, Entry 56 of List I allows the Union to intervene in the cases of interstate rivers if it is "declared by Parliament by law to be expedient in the public interest". The central government is thus empowered to enact a law for creating the desired institutional body entrusted with integrated development and regulation of water resources in the country. Accordingly, the central government has played a significant role in both regulating and developing the Brahmaputra and the Barak. Much of this intervention has been through the Ministry of Water Resources, which also includes the Central Water Commission, the National Institute of Hydrology, and the Central Groundwater Board.
- 6.15 In 1980 the Government of India set up the Brahmaputra Board, with an exclusive focus on the development and management of the Brahmaputra and Barak basins (see box 3). The devastating 2004 floods led to the establishment of a further task force to assess institutional capabilities for flood management. The task force concluded that organizational shortcomings had hampered efforts to protect the area against floods. Box 1 shows the chronology of organizational development relevant to the rivers of the Northeastern Region over the past decades. Box 2 summarizes the functions of those entities under the ministry.
- 6.16 In addition, at the state level, each state has established its own institutional framework for managing water resources in accordance with the water management issues faced. Assam, for example, established a Water Resources Department to deal with responses to erosion and flood management throughout the state. An Irrigation Department was also established and an Irrigation Act promulgated in 1983. To manage the impacts of natural disasters, including floods and earthquakes, a disaster management cell was established within the Revenue Department of the Government of Assam. Arunachal Pradesh, Nagaland, and Meghalaya have irrigation and flood control departments. In Tripura the Public Works Department takes care of flood and irrigation-related issues. Issues related to power development are treated through separate power departments in Arunachal Pradesh and Nagaland.

- 6.17 In general, these state agencies appear understaffed and underfunded. They are also dependent on data and information collected by the central agencies and since their mandates focus only on their respective states (combined with the fact that some focus on floods while others focus on irrigation or power) there is as yet no joint platform for regionwide interstate collaboration on water resource management issues.

Box 1. Historical development of organizations dealing with Northeast rivers

1954: Policy statement

1957: High-Level Committee on Floods

1958: Policy statement

1964: Ministerial Committee on Flood Control

1972: Minister's Committee on Floods and Flood Relief

1972: Working groups on flood control for five-year plans

1980: Rashtriya Barh Ayog

1980: Parliament of India passes the Brahmaputra Board Act; Brahmaputra Board established

1987: National Water Policy

1988: Committee on Flood Management in the North Eastern States (Naresh Chandra Committee)

1996: National Commission for Integrated Water Resource Development Plan (S. R. Hashim Commission)

1996: Regional task forces

2002: Report of the Committee on Silting of Rivers in India (Dr B. K. Mittal Committee)

2003: Report of the Experts Committee to Review the Implementation of Recommendations of Rashtriya Barh Ayog (R. Rangachari Committee)

2004, July: Report of the Technical Group on Flood and Erosion Problems of North Bengal (M. K. Sharma Report)

2004, December: Task force report on the problem of recurring floods in Assam and neighboring states as well as Bihar, West Bengal, and eastern Uttar Pradesh, under the chair of the Central Water Commission

Box 2. Functions of various agencies under Ministry of Water Resources

The **Central Water Commission** manages hydrometeorological data collection, prepares flood forecasts, undertakes surveys, analyzes data, and prepares detailed project reports. The Central Water Commission has 13 regional offices, one of which is located in the Northeastern Region at Shillong.

The **National Institute of Hydrology** was established to undertake, promote, and coordinate systematic and scientific work in all aspects of hydrology.

The **Central Groundwater Board** has responsibility for hydrogeological surveys, and for exploring, assessing, developing, and managing groundwater resources throughout India.

The **Brahmaputra Board**, which was perhaps intended to have the most significant central government function in the region's water management, has a range of responsibilities, which are outlined in box 3.

- 6.18 The Indo-Bangladesh Joint Rivers Commission was established in 1972. Its responsibilities include to maintain liaison between the participating countries in order to ensure the most effective joint efforts in maximizing the benefits from common river systems to both the countries; to formulate flood control works and to recommend implementation of joint projects; to formulate detailed proposals on advance flood warnings, flood forecasting, and cyclone warnings; and to study flood control and irrigation projects. Since the Brahmaputra and the Barak rivers are shared between India and Bangladesh, they fall within the commission's mandate.

Institutional considerations related to managing water resources in the Northeast

Background

- 6.19 A striking feature of the institutional structure is the confusing multiplicity of organizations at the central, state, and regional levels. Because water as a resource so broadly impacts all forms of life in so many ways, the orderly and sustainable management of this resource is profoundly complicated, more so in the Northeastern Region of India because of the sheer scale of the resource and the number of institutions involved. The frequent adjustment of the institutional framework in an attempt to address this task attests to its difficulty.
- 6.20 The considerations that follow are not unique to the water management institutions of northeast India by any means but are intended to reflect the challenges associated with a strengthened and more responsive institutional framework that can properly address the physical, political, and technical challenges associated with harnessing this resource to the betterment of communities' livelihoods in the region.
- 6.21 International experience has shown that functional water resource management needs to take place at more than one level and includes a number of key elements: (a) adoption of a basin-scale approach; (b) taking account of different sectors in an integrated manner to avoid competition and to create synergies where possible; (c) predictable financial support by government over a long time period; and (d) importantly, decentralization of management to the levels appropriate, by involving stakeholders in decisionmaking at various levels (for example, decisions relating to hydropower or upper catchment erosion are more likely to be of regionwide concern, whereas decisions relating to wetland protection or groundwater management are more matters of subbasin concern).

The situation in the Northeast

- 6.22 An integrated approach does exist in the Northeast, as expressed in the institution of the Brahmaputra Board (box 3), which has a regional mandate for development and management of both the Brahmaputra and the Barak basins. To some extent, there is also a state and local approach for more localized water management, albeit generally too weak and in need of capacity strengthening and funding, both at state and community levels.

Box 3. The Brahmaputra Board

The Brahmaputra Board was set up under an act of Parliament under the then Ministry of Irrigation (now renamed the Ministry of Water Resources). The board has been given responsibility for preparation of a master plan to control floods and bank erosion and to improve drainage in the Brahmaputra and Barak valleys, giving due regard to the development and utilization of water resources for irrigation, hydropower, navigation, and other beneficial uses.

The board has a full-time chair, vice-chair, general manager, financial adviser, and two chief engineers, appointed by the Government of India. The board is authorized to appoint such other officers and employees as considered necessary. The board also has representatives from the governments of Assam, Meghalaya, Nagaland, Manipur, Tripura, Mizoram, and Arunachal Pradesh, the North Eastern Council, the central Ministries of Agriculture, Irrigation, Finance, and Transport, the Central Water Commission, the Central Electricity Authority, the Geological Survey of India, and the Indian Meteorological Department. Originally, the chair had the rank of secretary to the Government of India, but in 2000 the rank was downgraded to additional secretary.

A Review Board was constituted by the government in 1982 to oversee the work of the Brahmaputra Board, with the Union Minister of Water Resources as its chair and with 14 other senior members.

The responsibilities conferred on the Brahmaputra Board by the central government are substantial and comprise a broad range of river basin development and management activities, from planning to construction and management of infrastructure, as follows:

- Conducting surveys and investigation in the Brahmaputra valley
- Preparing a master plan for the control of floods and bank erosion and improvement of drainage in the Brahmaputra valley, taking into account irrigation, hydropower, navigation, and other beneficial uses, and indicating, as far as possible, the works and other measures that may be undertaken for such development
- Preparing detailed project reports and cost estimates for dams and other projects proposed in the master plan
- Establishing standards and specifications for the construction, operation, and maintenance of such dams and other projects
- Constructing multipurpose dams and related infrastructure as proposed in the master plan, as well as maintaining and operating this infrastructure, all with the approval of central and state governments
- Preparing phased programs for the construction of all projects proposed in the master plan, in consultation with the concerned state governments

The Brahmaputra Board undertook the preparation of the master plan in three parts:

- Part I: Main stem of the Brahmaputra River
- Part II: The Barak River
- Part III: The tributaries of the Brahmaputra and the Barak, and the rivers of Tripura

Parts I and II of the master plan have been approved by the Government of India. Under part III, 41 tributary master plans have been prepared, of which 34 have been approved by the government and 7 are in different approval process states. However, almost no construction has taken place. This is at least in part related to the conditions under which the board is functioning, notably that:

- No multipurpose dam or other works can be constructed by the board unless the state government makes the required land available free of cost and also undertakes to take over project maintenance.
- No dam or other works can be undertaken by the board unless the state governments concerned agree to provide all assistance that may be required for construction, operation, and maintenance.

- 6.23 There is, however, a missing dimension, and that is active participation by the states and other affected stakeholders in regionwide water resource management planning and decisions. As pointed out in the previous subsection, there is only limited access to existing knowledge regarding the water resources of the Northeast, in part due to the secrecy surrounding data and data collection, and in part because the data simply do not exist. Accordingly, participation in decisionmaking is hampered because the basis for it is too weak.
- 6.24 Fundamentally, the Brahmaputra Board has been unable to fulfill its mandate. The reasons for this are intrinsic to the mandate itself, according to which it is supposed to coordinate and reach consensus with a large number of agencies (including central and state agencies), leading to long delays in decisionmaking. The mandate is also very limited and even ambiguous as far as execution of the schemes that have been developed by the board is concerned. A review of the way it has functioned reveals that the board has been grappling more with administrative and financial matters than developmental and technical issues. Factors that have contributed to the weak functioning of the board have been lack of authority and autonomy, lack of budgetary support and absence of powers in the Brahmaputra Act for raising of public or private funds, absence of regulatory powers, and the problem of top posts remaining vacant for long periods (Sharma 2006, Background Paper 8). Accordingly, in emergency situations like floods, when people looked to the board for help, it has proved unable to identify its role, making it difficult for it to provide relief or to implement immediate flood control measures. In the view of the stakeholders, including the state governments of the northeastern states and the beneficiaries (the people of the region), the Brahmaputra Board has failed to fulfill their expectations (bearing in mind that these may differ from the board's mandate). The generally negative opinion that people have of the board is accentuated by the inaccessibility of the master plans to entities outside the board, and the impression that it exhibits low work morale, having been frustrated in its development endeavours.
- 6.25 While these statements reflect a growing consensus they cannot be properly evaluated within the scope of this study, though there may well be a number of lessons that can be drawn from the experience with the Brahmaputra Board. Specifically, an effective river basin organization (a) needs to have an appropriate mandate, supported by legal provisions, if it is to fulfill the objectives that its creators and stakeholders envisage; (b) needs to engender the support of key stakeholders if it is going to succeed in providing support to local communities; (c) needs to be transparent in the data it collects, in the way the data are analyzed, and with the results that are produced if it expects to maintain any degree of credibility; and (d) needs to be largely resourced (staffed and financed) internally in the region to have any significant lasting impact.
- 6.26 It is also clear that a number of management and development functions would need to be performed in the Northeast in order to make beneficial and sustainable use of water resources. The structure of the board, its current mandate, and the lack of decisionmaking authority and funding, but also its secretive decisionmaking processes, are unsuited to the hard choices that need to be made, for instance with regard to the tradeoff between hydropower development (as envisaged by Arunachal Pradesh) and flood management (as needed by Assam – see next section). Appropriate management would also include improving the knowledge base in order to facilitate more informed

decisions. Experience with water resource management worldwide has shown that in federal countries, a certain devolution of decisionmaking powers to stakeholders at the basin level is important in order to improve outcomes.

- 6.27 Despite - or because of - the multiplicity of institutions the system is generally too weak and fragmented to coherently manage complex river basins that cut across several different states. It will, therefore, be critical to establish and maintain an appropriate cooperative management structure amongst all the states sharing river basins in the Northeast in order to achieve sustainable development. Achieving such cooperation will not be easy. The challenge is to create a management structure adapted to the particular characteristics of the basins, and to provide sufficient incentives and benefits for all relevant states to cooperate.
- 6.28 Why has the system failed to deliver the quality of management and the level of development necessary to support economic growth in the region? Institutions, like any organizations, need adequate resources - labor, equipment, and funds - to effectively discharge their duties. They also require clear objectives and the legislative backing to fulfill their objectives. Finally, and most significantly, incentives govern how well institutions utilize their available resources. The problem in the water sector of the Northeast is less the undersupply of physical inputs than their low productivity. There is no shortage of skilled and talented labor in the Brahmaputra Board or the other agencies, so poor performance cannot be attributed to labor deficiencies. However, most institutions under state control endure periodic financial squeezes, as cash-strapped states endeavor to control escalating budget deficits. Since the wage bill is fixed, the expenditure cuts have fallen disproportionately upon the operation and maintenance budgets. The result is poorly maintained and badly functioning infrastructure, widening the gap between policy expectations and policy outcomes. The confusing multitude of state and central agencies with overlapping mandates is a recipe for obfuscation and implies that it is difficult to hold a single agency responsible for poor performance.
- 6.29 But the greatest constraint on service delivery involves the less tangible factors that govern performance incentives. Secrecy and an emphasis on top-down systems have done little to promote accountability to consumers and stakeholders. Performance in such systems is necessarily measured in terms of physical (and measurable) targets, rather than outcomes. Since the public (consumers) are largely excluded from the planning process there are no signals or mechanisms to reward good outcomes or penalize bad results. Given the complexity of water resources and the diversity of stakeholders, it is practically impossible for even the most talented agency to manage resources in ways that accommodate the plethora of legitimate interests. It is in this context that openness and transparency give an opportunity to press for policy change long before problems emerge. Vigorous public scrutiny of a system is ultimately a source of strength that leads to stronger institutions with greater public trust and better outcomes.
- 6.30 The following sections will describe and analyze the performance of specific water resource management issues, the resolution of which could contribute to development of the Northeastern Region. In chapter 8, overall water resource management will again be considered and, in light of the findings related to the specific water resource

management issues, options for improving sustainable development and growth in the region will be analyzed.

Flood and erosion management

6.31 Floods in the Northeastern Region affect an annual average of 1.25 million hectares of land, but in some years affect more than 3.8 million hectares of Assam's total area of 7.8 million hectares. They inundate at least 2,000 villages in addition to destroying other infrastructure. The problem is further exacerbated by riverbank erosion, which destroys about 8,000 hectares of riparian land along the Brahmaputra annually. Vast areas in the region have been affected by erosion (1 million hectares in Assam; 815,000 hectares in Meghalaya; 508,000 hectares in Nagaland; 108,000 hectares in Tripura; and 14,000 hectares in Manipur). Every state in the Northeast suffers due to floods (table 3). Many human lives are lost, and transport bottlenecks result in indirect but very significant economic losses. Assam, however, is the worst sufferer in terms of direct economic damage.

Table 3. Flood damage in the Northeastern Region

State	Geographical area (million ha)	Average area affected (million ha)	Maximum area affected any one year 1953–2004 (million ha)	Area protected from floods 2006 (million ha)	Average (1953–2004) annual damage to crops, houses, and utilities (million rupees)
Arunachal Pradesh	8.374	0.051	0.207	0.003	473.2
Assam	7.844	0.941	3.820	1.636	881.4
Manipur	2.233	0.019	0.080	0.130	36.2
Meghalaya	2.243	0.012	0.095	0.001	121.3
Mizoram	2.108	0.091	0.541	-	38.9
Nagaland	1.658	0.002	0.009	-	27.0
Sikkim	0.71	0.094	1.170	0.002	66.9
Tripura	1.049	0.040	0.330	0.026	84.3
Total for Northeast	26.219	1.25	-	1.754	1,729.2
Total India		33.52	-	16.43	13,477.2

Source: Central Water Commission

Flooding and related costs

Significance and causes of flooding

6.32 A large part of the Northeastern Region, particularly the plain areas, is naturally subject to frequent and extensive flooding, especially from the Brahmaputra and Barak rivers (box 4).

- 6.33 Despite extensive efforts, mainly in the 1950–1970 period, to control flooding by the construction of embankments alongside rivers, disastrous flooding with loss of life and property continues to affect large segments of the population, to impoverish many, and to discourage investments that could generate employment and economic growth. Embankments are only partially effective, for several reasons: (a) they can contain only floods up to a certain magnitude; (b) they usually have gaps where tributary streams enter the embanked river; (c) they are susceptible to failure from river erosion or geotectonic instability; (d) they are often inadequately maintained due to lack of funding; and (e) they may be deliberately breached in order to release water impounded behind them.

Box 4. The Brahmaputra River

The Brahmaputra River, with a basin area of 580,000 square kilometers (50.5 percent in China, 33.6 percent in India, 8.1 percent in Bangladesh, and 7.8 percent in Bhutan), is among the largest, most flood-prone, and most unstable rivers in the world. Its dynamic fluvial regime is marked by very high rates of water and sediment discharge, dramatic bank line migrations, rapid bed level changes, and accelerated rates of basin denudation. Originating from the great glacier mass of Chema-Yung-Dung in the Kailash range of southern Tibet at an elevation of 5,300 meters, where it is called the Tsangpo River, it flows for 1,625 kilometers through Tibet (China). It is known as the Siang or Dihang when it enters India in Arunachal Pradesh. After its confluence with the Lohit River downstream of Pasighat it is called the Brahmaputra. It traverses India for a distance of 918 kilometers before flowing into Bangladesh, where it is generally known as the Jamuna below the offtake of the Old Brahmaputra. The characteristics of the river are very similar in Assam and Bangladesh. In Assam, however, the river lies in a well-defined alluvial valley ranging from 40 to 100 kilometers in width and bounded by mountains and hills, whereas in Bangladesh the environment is more deltaic in nature.

The drainage areas of the river at the east and west ends of Assam are roughly 290,000 and 530,000 square kilometers in extent. In its course through Assam and Arunachal Pradesh, the long-term mean discharge rises from about 8,500 to 17,000 cubic meters per second as flows are augmented by the major tributaries within India. The northern tributaries drain the southern slopes of the Himalayas and together contribute much more water and sediment to the river than the southern tributaries.

In the course of its journey, the Brahmaputra receives as many as 22 major tributaries in Tibet, 39 in India and 3 in Bangladesh. The important tributaries in India are the Subansiri, Manas, Dhansiri, Kopili, Teesta, Jaldhaka, and Torsa. The northern and southern tributaries of the river in India differ significantly in their hydro-geomorphologic characteristics, owing to different geological, physiographic, and climatic conditions. The north bank tributaries generally flow in shallow braided channels, have steep slopes, carry a heavy silt charge, and are flashy in character, whereas the south bank tributaries have a flatter gradient, deep meandering channels with beds and banks composed of fine alluvial soil, and are marked by a relatively low sediment load.

The Brahmaputra is one of the largest alluvial rivers of the world and exhibits a high degree of braidedness. It flows through a seismically active region, and its basin is home to fragile ecosystems that are rich in biodiversity. In addition, any possible trajectory of water resource development has to accommodate the uncertainties associated with the impacts of climate change and economic development in the region. The challenge of environmentally sustainable development and management of water resources is, therefore, compounded by the need for a development approach that is functional and resilient over the long term.

- 6.34 With most rivers flowing in alluvial valleys, regular overbank flooding is a natural characteristic, with the bankfull discharge, which just fills the river channel without overtopping the banks, usually exceeded every two to five years. In the Brahmaputra, this tendency to frequent overbank flooding is aggravated by two additional factors related to sediment. First, the load of sandy bed sediment that tends to build up the riverbed is comparatively high in relation to the fine-grained wash load that tends to build up the floodplain, so that the river is prone to frequent changes in its course and to flowing above the floodplain in the embanked segments. Second, the 1950 earthquake, which delivered unusually large quantities of bed sediment, raised Brahmaputra riverbed levels throughout Assam, by up to 3 meters at the upstream end in Assam and in parts of Arunachal Pradesh. However, the significance of these sediment-related factors is far from being clearly established.
- 6.35 Flooding of valley bottom lands is also caused by rainfall floods in tributaries, which may or may not coincide with floods in the main stem rivers. Another occasional cause of devastating flooding that may occur with little or no warning is the sudden breaching of temporary dams formed by landslides in the upper reaches of tributaries.
- 6.36 Contributory factors to the flooding include inadequate maintenance of flood embankments, excessive encroachment into vulnerable areas of the floodplain, and incomplete infrastructure. These mainly result from insufficient funding, lack of a strategic approach to maintenance of existing infrastructure, and increasing population density.

Figure 7a. Flood-affected crop area as percentage of total cropped area

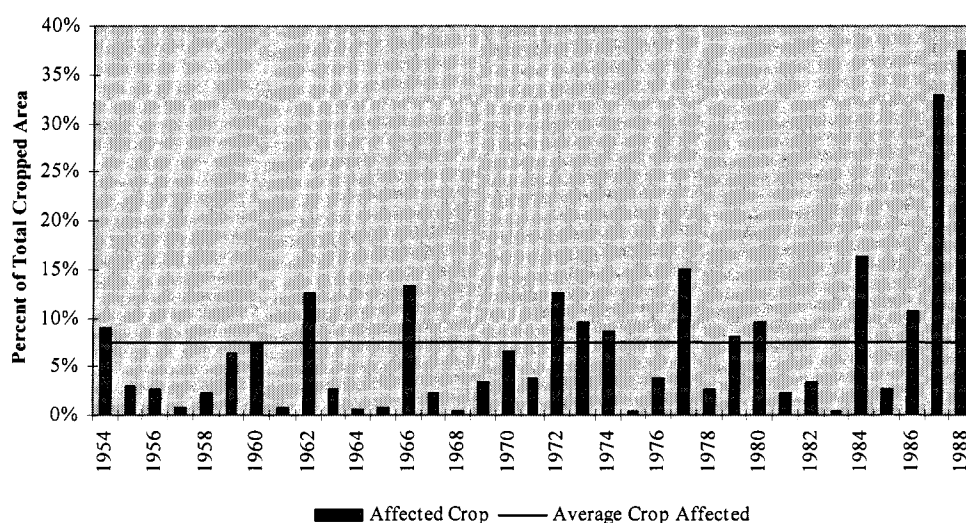
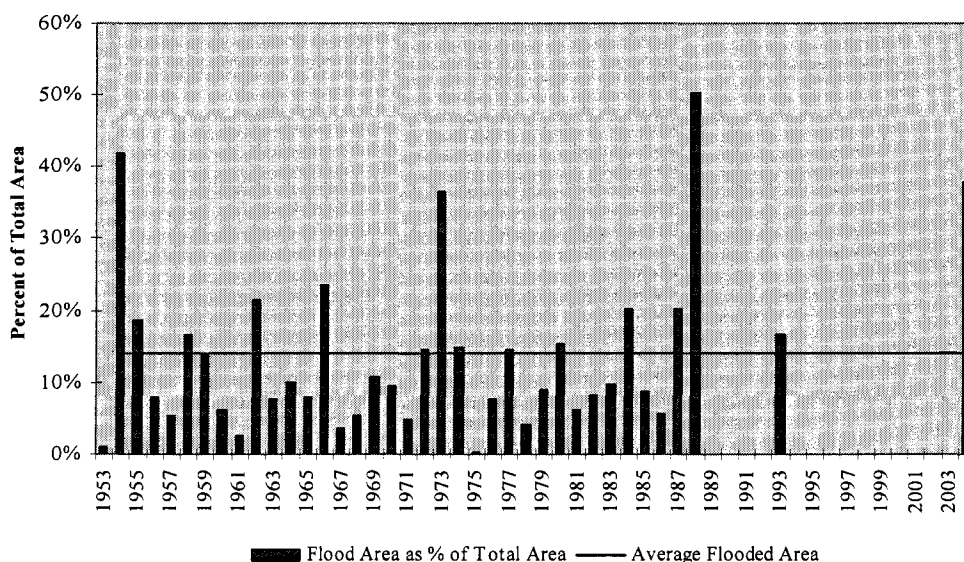


Figure 7b. Flood-affected area as percentage of total area



Sources: (a) *State of India's Environment: A Citizen's Report* (page 73), Centre for Science and Environment; (b) Discussions with and handouts from Assam Water Resources Department.

- 6.37 According to information obtained from the Assam Water Resources Department, high levels of flooding occurred in 1954, 1959, 1962, 1966, 1972, 1987, 1988, 1993, and 2004 – on average, about once every five years. Flooded areas in Assam in those years ranged from about 1 million hectares in 1959 to nearly 4 million hectares in 1988, but do not appear to show any clear trend. However, the magnitude of floods varies significantly from year to year (figures 7a and 7b). The figures indicate that the proportion of total cropped area flooded was highest in 1987 and 1988, as was the proportion of total area flooded. The average area flooded for the nine years of highest flood is 2 million hectares or 20,000 square kilometers – equivalent to an area 400 kilometers long and 50 kilometers wide, or about 25 percent of the area of Assam.

Wetlands

- 6.38 Wetlands, most commonly represented by beels or shallow ponds, play an important role in the Assam valley, both in the Brahmaputra and the Barak basins. Wetlands are under considerable pressure from agriculture and other industries and to a large extent have been neglected. This has resulted in habitat degradation as well as a general

decline in the total surface area of beels (also spelt “bils”).¹¹ In addition to a range of ecological and socioeconomic values, wetlands can play an important role in reducing floods and erosion since they store and gradually release water to the major rivers. Because the volume stored in beels is relatively insignificant compared to Brahmaputra flood discharges, their role in flood attenuation may not be substantial. Nevertheless, the beels serve as a significant source of biodiversity, provide fish habitat, promote groundwater recharge, and support wildlife habitat.

Flood damage

- 6.39 The social disruption and costs associated with flooding have been rising. This is certainly in part because of increasing human occupation and associated economic activity on the floodplain but there is a perception that this is also due to an increased magnitude and frequency of floods in recent years. Table 4 provides a summary of damage trends.
- 6.40 To the extent that the data are reliable, table 4 illustrates a number of important points:
- Contrary to the perceptions of some, the average annual area flooded does not indicate an upward trend despite inclusion of the 2004 flood in which a total of more than 2.8 million hectares were inundated, of which almost 1.3 million hectares were cropped.
 - Cropped area as a percentage of total area has steadily increased, probably reflecting increased cropping intensity to satisfy the food requirements of an increasing population.
 - The increase in affected population per hectare of flooded land reflects increasing population density.
 - Despite significant increases in the reported average annual damage due to flooding in the period 2000–2004, the value of crop lost as a percentage of this total damage has fallen to 14 percent from a high of 75 percent in the 1990s. This may imply that the nonagricultural component of the economy has increased significantly and, along with higher-value infrastructure, accounts for a greater proportion of the flood damage.

¹¹ The Assam Beel Fisheries Corporation estimated beel areas to be about 100,000 hectares in 1970. Rashtriya Barh Ayog 1980, Report Volume 1, reported the area under beels at 49,000 hectares. A subsequent study by D. C. Goswami and P. Sharma in 1988, *Waterlogged Lands in Naogaon District Assam: A Study in Environmental Geomorphology*, stated that there were approximately 1,600 such water bodies covering 35,630 hectares.

Table 4. Flood damage trends in the Brahmaputra valley of Assam

Period	Average annual area flooded (million hectares)		% of crop area flooded	Average annual damage (million rupees) ^a		Value of crop lost as % of total damage	Average annual population affected
	Total	Cropped		Total	Crops		
1953-1959	1.13	0.12	10.6	59	39	66	860,000
1960-1969	0.75	0.16	21.0	76	70	92	1,520,000
1970-1979	0.87	0.21	24.5	152	136	89	2,000,000
1980-1989	1.16	0.40	34.2	1,755	754	43	4,020,000
1990-1999	0.70	0.22	31.3	1,117	843	75	3,380,000
2000-2004	1.18	0.43	36.0	15,956	2,150	14	5,910,000

^a Unadjusted for inflation.

Source: Assam Water Resources Department.

- 6.41 The reported average annual damage sustained over the past five years is about US\$163 million. Table 5 presents several scenarios that provide an indication of the scale of funding that could be economically justified to address this problem.¹²

Table 5. Justifiable capital expenditure for corresponding percent reduction in average annual flood damage

Reduction in annual average flood damage	Justified capital expenditure (US\$ million)
100%	973
50%	575
25%	287

Source: Northwest Hydraulics Consultants, 2006

Erosion

- 6.42 The foregoing analysis does not take account of losses resulting from a related calamity – erosion. The estimated area of 386,000 hectares eroded since 1954 has reportedly affected more than 90,000 families and about 2,500 villages, and translates into an annual erosion rate of about 8,000 hectares. The present value of the foregone production on the 386,000 hectares amounts to something in the order of US\$790 million, and this does not

¹² This analysis represents a crude estimate of foregone marginal productivity assuming that (a) economic value of crop losses are 85 percent of their market value; (b) economic value of property losses are 50 percent of the market value; and (c) the discount rate is 10 percent with a period of 35 years.

include the social costs.¹³ Erosion most seriously affects Assam, Meghalaya, Arunachal Pradesh, Sikkim in the Teesta and Rangit basins, and Mizoram in the Barak basin.

Flood relief: Action taken

- 6.43 In response to flooding between fiscal years 1983 and 1987, six of the eight northeastern states sought flood relief from the central government amounting to US\$195.5 million and received assistance of US\$36.1 million. The flood-prone area in these states was estimated to be 5.5 million hectares (table 6). Assam, which contained 88 percent of the flood-vulnerable area, sought and received assistance amounting to 77 percent and 72 percent respectively of the totals. Between 1999 and 2004, when average annual flood damage in Assam was estimated at US\$163 million, the allocation of the Central Relief Fund averaged US\$21 million.¹⁴

Table 6. Central flood assistance sought and received and area affected

State	Maximum flood area affected 1953-2004 (million ha)	Assistance sought 1982-1987 (million US\$)	Ceiling approved by central government 1982-1987 (million US\$)
Assam	3.820	150	26
Meghalaya	0.095	5.3	1.9
Manipur	0.080	4.4	0.9
Nagaland	0.009	1.4	0.2
Sikkim	1.170	24.0	3.1
Tripura	0.330	10.4	4.0
Total Northeast	5.504	195.5	36.1

Source: Center for Science and Environment 1992 and Central Water Commission.

- 6.44 Relief is at best a short-term response to the flooding and certainly not a desirable longer-term solution. The difference between the level of assistance sought and

¹³ Based on loss of production in an area that increases by 8,000 hectares per year over a period of 50 years. Assumes yields of 1.5 metric tons per hectare, and interest rates of 10 percent. The cost of 1 metric ton of unmilled rice is about US\$165.

¹⁴ More recent figures available for Assam show that by the year 2000 the central government had released Rs. 3,909.4 million as loan and Rs. 100.9 million as grant in aid for flood relief. In addition, Assam received, from the Non-Lapsable Central Pool of Resources, Rs. 250 million under the Assam Reconstruction Plan as one-time additional central assistance for flood protection works during 2004-2005. Furthermore, a scheme for critical flood control and antierosion schemes in the Brahmaputra and Barak valleys under the state sector, estimated to cost Rs. 1,500 million, is scheduled for completion during the 10th Plan, being financed as a 90 percent central government grant and 10 percent loan to the state. This scheme may increase to a total of Rs. 8,300 million. The process is under approval.

assistance granted is a compromise resulting in part from disagreements over the assessment of damage, in part because of a general shortage of financial resources, and in part political. There are indications from different sources (notably from the insurance sector) that overall damages are not as high as presented here. They are, nevertheless, substantial and will continue to rise as population and economic activity in the Assam valley increase. The need for substantial postflood relief is a reflection of the technical difficulty of managing flooding and erosion, and the failure to provide appropriate levels of relief further punishes the victims.

History of flood and erosion management

- 6.45 While there were ancient historical precedents for the practice of constructing flood protection embankments in India, systematic nationwide flood protection programs were initiated only after independence. Prior to independence there were some 5,000 kilometers of embankments, mostly in two regions: about 3,500 kilometers in the Sundarbans and 1,200 kilometers along the Mahanadi in Orissa. During the imperial period, committees were appointed from time to time to look at flood problems. With respect to Assam, these committees reviewed the flood problem in 1929, 1934, and 1947. However, recommendations are generally considered to have been based on an inadequate understanding of Brahmaputra River behavior and were rarely implemented.
- 6.46 Following independence, the first plan (1951) moved conceptually away from embankments towards large dams intended to store floodwaters, though none of these initial dams were conceived for the Brahmaputra or its tributaries.¹⁵ Assam experienced severe flooding in 1954, which prompted the formulation of a three-pronged flood strategy.¹⁶ As an immediate step, selected towns and other priority areas were to be afforded protection through the construction of new flood embankments. At the same time, technical investigations were initiated on extending existing embankments, improving drainage channels, raising villages, and protecting towns. The intended long-term strategy was to construct dams and additional embankments wherever necessary.
- 6.47 Within several years of formulating the 1954 strategy, and before implementation had proceeded very far, it was increasingly recognized that more work was needed in the areas of watershed management programs and flood warning systems. Also, the appropriateness of embankments as a flood protection measure was called into question because of perceived problems such as confinement of flows, which increased flood levels, and reduced natural drainage and accompanying waterlogging. In 1958 the Government of India stated that "the various flood control measures either executed or visualized should not lead to the wrong impression that complete immunity from flood damage is physically possible in some distant future. Any such illusion has to be dispelled."

¹⁵ The first dams were conceived on the Damodar, Mahanadi, and the Kosi. However, the proposed dam on the Kosi was considered too close to the epicenter of an earlier major earthquake so Nepal remained relatively unenthusiastic and this project was shelved at that time.

¹⁶ None of the other states experiencing flooding in 1954 were in the Northeast but included Uttar Pradesh, Bihar, and West Bengal.

- 6.48 Over the years, a variety of committees and working groups analyzed options for flood management in the Northeast. Throughout the more than three decades during which flood management policy was evolving, necessity dictated that physical interventions continued. Despite well-founded concerns over embankments, they were in fact the only reasonably cost-effective measure that afforded protection from lesser floods, and their construction went on practically unabated in the Brahmaputra and Barak basins of the Northeastern Region (table 7).
- 6.49 As work on flood management infrastructure progressed, it became apparent that erosion control was inextricably linked with flood management, since embankments that were intended to reduce overbank spill were being destroyed by river erosion. At the same time, drainage improvements were required to accommodate problems created by embankment construction. The significant investment in infrastructure over almost six decades in the Brahmaputra and Barak basins, therefore, included measures to control flooding, improve drainage, and reduce erosion.
- 6.50 The existing infrastructure in Assam includes about 4,500 kilometers of embankment (including about 700 kilometers along the Barak River), 85 major regulators (sluices), 850 kilometers of drainage channels, and more than 680 structures to manage erosion, including spurs,¹⁷ porcupine fields, and revetments.¹⁸ The replacement value of the existing infrastructure is estimated at something over US\$1,000 million.

Table 7. Northeastern Region flood management infrastructure by state

State	Embankments completed to 1987 (km)	Area protected (million ha)	Status of large dams (1986)	
			Completed	Under construction
Arunachal Pradesh	7	0.003	..	..
Assam	4,459	1.636	1	1
Manipur	500	0.13	..	..
Meghalaya	116	0.001	3	..
Mizoram	..	..	..	..
Nagaland	..	..	..	..
Sikkim	..	..	..	..
Tripura	114	0.03	..	..
Total Northeast	5522	1.796	4	1

.. Zero or insignificant.

Source: Center for Science and Environment 1992 & www.indiastat.com

¹⁷ Groin or spur dike: An obstruction of stone, timber, brushwood, or earth constructed from the bank of a channel and projecting into it for training the flow (ASCE Task Force 1962).

¹⁸ Revetment: A type of bank protection which covers continuously the entire slope of a bank or an embankment, including the portions extending far into the riverbed, to keep the bank from receding landward owing to erosion (ASCE Task Force 1962).

Local-level arrangements for “living intelligently with floods”

- 6.51 The above subsections have dealt with flood management at the river basin level. In addition to flood management, which aims to mitigate risks at the broader level, it is also important to recognize that floods in the Brahmaputra and Barak valleys are a fact of life and will not go away. Accordingly, local communities could and should be enabled to cope with floods such that they can minimize their risks and, possibly, even benefit from them.
- 6.52 Background Paper 5 (Hazarika 2006) outlines options for “living intelligently with floods”. These revolve around improving the quality of flood awareness, strengthening local capacity to deal with disaster preparedness, risk mitigation and prevention, and risk coping. A strategic approach would include learning from and promoting innovative interventions by farmers to develop combined traditional rice crops that can survive high water and can be replicated across the floodplains, and introducing better-quality cattle and veterinary extension services to reduce the vulnerability of those dependent on crops. There are also suggestions to help communities develop high platforms that can be used for shelter during floods. Some communities see these as an alternative to embankments, which are viewed as interventions that trap floodwater while “leaking” funds. This is partially linked to the lack of transparency in the current flood management system, with a resulting lack of public awareness of which structures serve what purpose. It also reflects the fact that maintenance of structures such as embankments is not carried out strategically, based on vulnerability assessments, but is rather too broad based, and may sometimes have adverse effects.
- 6.53 High platforms are used extensively in the northeast of Bangladesh and have been shown to be difficult to maintain, since they are subject to both wind-induced wave erosion and river (current) erosion. Accordingly, maintenance costs are significant and involve not only financial costs, but transaction costs in terms of community mobilization and coordination for long-term sustainability of these structures.
- 6.54 An additional activity to be considered for improving community capacity to deal with floods is the creation of a network of boats to take health services to those most vulnerable to floods.
- 6.55 The above are just a set of examples that could be further explored. Once focus is put on building community strength (and involving communities in both macro and micro solutions), their validity could be assessed and further options developed.

Options and constraints for improved flood and erosion management

Public knowledge and consultations

- 6.56 Flood and erosion management at local level is the responsibility of the states. Usually the state governments construct the schemes and remain responsible for their maintenance. The beneficiaries tend to remain uninvolved though they do demand such schemes in their area and also find a voice through public representatives and political leaders. Involvement of beneficiaries needs to start at the local level and that requires appropriate actions from the states. At the same time, the Brahmaputra master plan and subbasin plans are not available in the public domain and it is not clear to what extent, if any, there was meaningful public input to the various critical issues that the plans

involve. Given the reported difficulties associated with obtaining access to raw data and the general inaccessibility of the completed planning documents, it is unlikely that there is significant public awareness of, let alone support for, the plans that have been prepared (see previous subsection for community perceptions about embankments). Accordingly, institutional change that would more strongly involve local decisionmaking is necessary for both those undertakings carried out by the states and those carried out through regional bodies.

- 6.57 The Brahmaputra and Barak are both international rivers and this is probably a contributing factor to the lack of transparency. Nevertheless, experience elsewhere has clearly demonstrated that where local stakeholders have not contributed in a significant way to resolving issues associated with management of a key resource such as water, they become adversaries of the development process – particularly where plans, once implemented, cannot or do not meet expectations. This is particularly acute in the case of flood management or flood control where these terms mean the provision of a certain amount of (not total) protection.

Agriculture and land use adaptation

- 6.58 The master plan could benefit from more consideration of policy options to promote adaptive land use, particularly with respect to agriculture. In practice this would involve shifting agriculture production systems to the rabi (boro rice) and kharif I seasons, relying heavily on groundwater development and thereby reducing reliance on the kharif II season, when crops are most susceptible to flooding. Floods will not be eliminated, and as populations in the Northeast continue to expand, alternative measures are needed to ensure stable incomes and food production.

Adaptation to climate change

- 6.59 It is not clear to what extent climate change has been incorporated into the Brahmaputra master plan. Studies have indicated that initially the impact of snow melting in the high Himalayas will increase flood discharges in the Himalayan catchments over the coming decades (IPCC 2001). Singh (1998) suggests that an increase in surface temperatures will lead to a rise in the snow line, increasing the risk of floods in northeast India during the wet season. An assessment of the implications of climate change for hydrological regimes and water resources in the Brahmaputra basin using scenarios developed from the Hadley Center model simulations indicates that, once the snow melt effect has passed, by the year 2050, the average annual runoff in the Brahmaputra River will decline by 14 percent. In another model, according to information from the Ministry of Water Resources, studies carried out by the Geological Survey of India (GSI) indicate that glaciers may recede due to subnormal snowfall, higher temperatures during summer, less severe winters, or a combination of all of these factors. Under this scenario there would be less increase in flooding than predicted by other models.
- 6.60 Thus, the exact impacts of climate change are still under investigation. It is clear though that climate change is likely to have extensive impacts on the land-water system. Further research is needed, as well as the development of adaptation measures that incorporate climate change responses into long-term planning. Dealing with existing climate variations through good construction quality and strengthened operation and maintenance is also good preparation for dealing with climate change.

Broadening the information base: Nonstructural measures

Research and monitoring

- 6.61 The rehabilitation of flood control embankments and the location and design of spurs and other erosion management structures would be facilitated with improved measurement of basic river processes, contributing to better analysis and a more complete understanding of river behavior. This would involve increased financing for such equipment as differential global positioning systems combined with echo sounders for improved bathymetric surveys; hand-held global positioning systems to undertake float tracking to document and map changes in current vectors; and an acoustic Doppler current profiler (ADCP) for discharge and flow measurements. The latter is particularly useful for morphological investigations since it provides insight into where flows concentrate and their direction.

Satellite image-based morphological studies

- 6.62 Sequential satellite imagery can provide an accurate perspective on changes to riverbank lines, both temporally and spatially. As an initial step there is a need to more carefully analyze and map these changes to (a) provide a reliable database of river movement; (b) provide an indication of erosion risk along the river; and (c) indicate trends (if the erosion is accelerating or decreasing). This goes for both Assam and Arunachal Pradesh.
- 6.63 To accomplish this for the major erosion-prone areas of the region, imagery would need to be obtained at a reasonable resolution and dating back several decades. Based on preliminary investigation, Landsat images appear to be the best option and would need to be procured from appropriate vendors. One recommended analysis would involve generating three sets of mosaic images using the identified images of 1972–1973, 1993–1994, and 2002–2003. Using digital image classification techniques each set of images would be classified showing land, water, and sand classes of the study area. The bank line would be digitized from the images; channel migration maps prepared using the three sets of images; and bank line erosion and accretion maps prepared. While such exercises have been conducted for some stretches of the Brahmaputra River and its tributaries, they have been confined to the level of academic exercises or isolated research projects. A systematic program is needed to provide a comprehensive assessment of the severity and spatial extent of the erosion problem in the region.
- 6.64 The next stage of this program would involve systematic development of morphological prediction tools based on satellite imagery, which would allow an assessment of erosion vulnerability. Based on this analysis, investments in bank and embankment protection can be applied in a proactive manner.

Flood and erosion control: Technical issues

- 6.65 There are a number of key technical issues related to flood and erosion control that merit attention, as discussed briefly below. Because of the very limited amount of accessible information, it is difficult to know whether these issues have been adequately addressed in previous studies.

Levels of flood protection

- 6.66 It would seem appropriate to establish minimum levels of flood protection, in terms of expected frequency or probability of overtopping, for different categories of land or property requiring protection – for example agricultural land, villages, and larger towns or cities. The population should be made fully aware of the limitations of flood protection, and be fully informed of planned emergency measures to provide warning and protect life when larger events occur.

Hydraulic consequences of embankments

- 6.67 Using historical river discharge and water level data, efforts should be made to establish whether, as alleged in some documents, existing embankments have in fact raised flood levels by eliminating overbank spill and confining flood flows within the boundaries of the river itself. Attention should be given to the consequences of further extending the embankment system, both within Assam and downstream in Bangladesh. Consideration should also be given to relevant experience in Bangladesh. Regardless of the findings, removal of existing embankments does not appear to be a realistic option.

Feasibility of proposed storage dams

- 6.68 The contemplated multipurpose dams on the Dihang (Siang project) and Subansiri rivers are high and appear to be located in a seismically active region that has experienced major earthquakes. It is not known to what extent this problem has been addressed by technical studies. The interjurisdictional problem associated with these dams is another question. The flood control benefits of the dams appear to be somewhat limited (see paragraphs 6.95 onwards).

Landslide dams on tributaries

- 6.69 On some north-side tributaries of the Brahmaputra as well as in Sikkim, the hazards to life resulting from the formation and breaching of temporary dams composed of landslide detritus can apparently be very high. It is difficult to evaluate the geographical extent of this problem, but it seems to merit more documentation and the development of systems for warning, evacuation, and perhaps controlled breaching.

Erosion control

- 6.70 The erosive potential of the Brahmaputra River is extremely high and has led to frequent pulling back or retiring of flood control embankments, with adverse social consequences. Assam has made limited efforts to avoid this by constructing spurs at right angles to the embankments in some vulnerable locations. Observations and discussions in Assam indicate that the methods used have been fairly successful (in contrast with experience to date in Bangladesh) and that considerable benefits would accrue from substantial expansion and acceleration of spur construction where embankments are under immediate or near-future threat.

Floodplain agriculture

- 6.71 The National Commission on Agriculture (1976) recommended that one way to minimize the damage from flooding was to change the cropping pattern so that the flood season was avoided. It is not clear to what extent this recommendation has been

acted on, though a 1997 commission noted that (a) yields of rice in the Northeast averaged 1.3 metric tons per hectare while the national average was 1.9 metric tons per hectare; (b) only 7 percent of the rabi (winter season) crop was irrigated; and (c) the irrigable area in Assam was about 2.7 million hectares, of which about 627,000 hectares were actually irrigated (Shukla and others 1997). There appears to be considerable opportunity for gains in the production system by better adapting agricultural production systems to the environment of the Brahmaputra valley.

Fisheries

- 6.72 Fish are an important source of protein in the diet of the people of the Northeastern Region. The annual production of fish is reportedly about 170,000 metric tons and the estimated requirement is about 280,000 metric tons (Singh and others 2004). Considering their contribution to groundwater recharge, their potential to moderate smaller floods, and their role in providing fish habitat, the lack of attention to the wetlands and beels should be of some concern.

Public participation and disaster relief

- 6.73 There seems to be a lack of public information, education, and participation in flood and erosion control issues, and a lack of institutional arrangements to provide shelter and livelihood for the numbers of people who are displaced by flooding, erosion, and the retiring of embankments.

What needs to be changed to improve incentives for better flood and erosion management?

- 6.74 From the above exposition it has become clear that effective flood and erosion management in the Northeast is an essential ingredient in promoting development and growth in the region. Assam is the largest state and the economic engine of the Northeast. As pointed out by Verghese (2006), “without Assam the Northeast will not prosper”. The modifications in the institutional arrangements that are needed to increase incentives for effective stakeholder involvement are similar to those for water resource management in general, as outlined at the start of this chapter. Such changes would include:
- The creation of an effective river basin management organization that would focus on the basin as a whole, but with decentralized capacity and decisionmaking where possible and necessary
 - An expanded database, generally available to stakeholders, on the river systems and related phenomena
 - An amended system for allocating flood alleviation funds to reduce the incentive to overestimate flooded areas
 - Increased transparency in planning, design, and implementation of flood and erosion mitigation work to increase stakeholder support and to reduce opportunities for political interference and corruption.
- 6.75 Increased transparency should result in improved public confidence, paving the way for budget allocations that are more directly linked to long-term meaningful

accomplishments rather than short-term projects. This is particularly relevant if a more strategic and responsive approach is to be taken to erosion management, which demands that funds be available for interventions that respond to changes in the river system, rather than the more traditional approach of defining, well in advance, a reach of the river where protection will be provided – whether or not active erosion is taking place.

- 6.76 The above could be delinked from activities and financing that would support the communities themselves in dealing with floods, in order to provide incentives to focus also on these activities.
- 6.77 In summary, fundamental changes in the institutional arrangements related to flood and erosion management, occurring at all levels and linking the macro with the micro level, are an essential precursor to the implementation of specific recommendations to deal with the threats posed by floods and erosion.

Hydropower

- 6.78 Owing to the topography and the abundant surface water resources, the Northeastern Region is endowed with a very high hydropower potential. Very little of this has been harnessed to date, and several issues need to be resolved before the region benefits from the development of this sector.
- 6.79 Before turning to the significance of hydropower within the Northeastern Region, this section provides the all-India context of surging national energy needs, which need to be taken into account in assessing the options for the northeastern states to benefit from this rising demand.
- 6.80 In spite of considerable achievements in the development of power generation, India continues to face widespread power shortages. During 2004–2005, the shortage was about 12 percent in peaking capacity and 7.3 percent in energy. The power shortage in the Northeastern Region is about the same level (11.3 percent in peaking and 6.3 percent in energy) as that of the country as a whole. The actual shortages, particularly the peak shortages, would be higher if unscheduled power cuts and various control measures are taken into account. The situation in the Northeast is also further constrained by the inadequacies in transmission, subtransmission, and distribution compared to the country as a whole. The total demand for power in India is expected to increase by 350 percent in the next two decades, even under a best-case scenario that envisions intensified efforts to modernize power plants, improved transmission and distribution efficiency, and adoption of more efficient generation technologies (Planning Commission 2002). This soaring demand for power will necessitate a tripling of the installed generation capacity to about 292,000 megawatts over the next two decades. The additional generation capacity required for meeting the power demand by 2012 is estimated to be 116,000 megawatts, and at least about 28 percent of these should be added in the hydro sector (table 8). To achieve this, the Government of India has announced an ambitious 50,000 megawatt hydropower development plan. Developing hydropower in the Northeastern Region is an important part of the plan.

Table 8. 2001–2012 plan for electric power generation

		Type of power				
		Thermal: Coal (MW)	Thermal: Gas /LNG (MW) ^a	Nuclear (MW)	Hydro (MW)	Total (MW)
Installed capacity (March 2001)		61,157	11,017	2,720	25,116	100,010
Additional capacity required (2001–12)		53,333	20,408	9,380	32,673	115,794
Total by 2012	Installed capacity	114,490	31,425	12,100	57,789	215,804
	Mix	53%	14.6%	5.6%	26.8%	100%

a. LNG: liquefied natural gas.

Source: Government of India, Tenth and Eleventh Five Year Plan projections.

6.81 Economically viable hydropower generation potential in India from all types of hydropower projects is assessed to be about 251,000 megawatts. Most of the large project potential comes from the Northern (36 percent) and Northeastern (39 percent) Regions.¹⁹ So far, only 19 percent of the countrywide potential has been developed, and about 9 percent is under various stages of development (the corresponding figures for the Northeastern Region are 1.7 percent and 4.3 percent respectively) (table 9).

Table 9. Status of hydroelectric development (as on 1 July 2005)

Potential by region	Assessed potential (at 60% load factor)	Already developed (at 60% load factor)		Under development		Developed + under development	CEA-cleared schemes (60% load factor) ^a		Developed + under development + CEA cleared ^a	
	MW	MW	%	MW	%	%	MW	%	MW	%
Northern	30,155	5,150	17.1	2,622	8.7	26.7	1,577	5.2	9,349	31.0
Western	5,679	2,936	51.7	498	8.8	60.5	184	3.2	3,618	63.7
Southern	10,763	5,924	55.0	153	1.4	56.5	516	4.8	6,593	61.3
Eastern (minus Sikkim)	4,307	1,314	30.4	80	1.9	32.3	356	8.3	1,748	40.6
Northeastern (with Sikkim)	33,140	570	1.7	1,036	3.1	4.8	399	1.2	2,004	6.0
All India	84,044	15,891	18.9	4,389	5.2	24.1	3,032	3.6	23,312	27.7

a. CEA: Central Electricity Authority.

Source: CEA

¹⁹ Note that Sikkim is included in the eastern region (defined for grid connection); the share of the Northeastern Region would be higher if Sikkim were included.

- 6.82 The total remaining hydropower generation potential available in the Western, Southern, and Eastern (without Sikkim) Regions is limited (but still about 15 percent of the potential in the country). In these regions, most of the (peninsular) rivers have monsoon flows exceeding 80 percent, and require large storage reservoirs for economically viable hydropower generation, constrained by submergence, environmental, and interstate issues. For meeting peaking power demand, and ensuring a good hydro-thermal power mix of these regions and the nation as a whole, the requirement for future generations from the hydro sector will need to be met from the Northern and the Northeastern Regions (including Sikkim). A number of projects have started in the Northern Region (including central, state, and private sector projects); and further projects are soon to be implemented. However, in the long run, say in the 13th and 14th Five-Year Plan periods (2020–2030), the Northeastern Region will assume greater significance in the national plan.
- 6.83 Preliminary feasibility studies (by the Central Electricity Authority) concluded that 78 of the 162 projects in the country have an economical first-year tariff (< Rs. 2.50 per kilowatt-hour²⁰). Of these, 30 projects with installed capacity of 23,286 megawatts are in the Northeastern Region. Further, half of the projects in the Northeastern Region (16 schemes, 18,366 megawatts) will have a first-year tariff of less than Rs. 2 per kilowatt-hour.
- 6.84 Therefore, a substantial block of economical potential is available in the Northeastern Region to meet the power needs of the country. Given the constraints that lack of available energy would put on India's growth, there will clearly be significant pressure on the Northeastern Region to develop this hydro potential. The issue is whether the northeastern states will manage to harness the potential of hydro to their citizens' benefit within an arrangement that would help stimulate development and growth of both the Northeastern Region and the nation.

Hydropower in the Northeastern Region

- 6.85 The Brahmaputra-Barak river system drains a large catchment area, has the largest surface water potential, and 30 percent of the hydropower potential²¹ (or 41.6 percent of the principal hydro potential) of the country. The number of identified hydropower generation sites in the Brahmaputra basin is 140 (out of the 845 sites in the country; for comparison, 226 sites are on the Ganges and 180 on the Indus).
- 6.86 Within the Northeastern Region, Arunachal Pradesh has a share of about 81 percent of the potential for principal hydro (31 percent of all India potential). Except for Assam and Tripura, which have developed a substantial part of their small potential, all other states have about 1,000 megawatts of potential unused. Immediate government plans include projects in Sikkim and Mizoram only (table 10). In terms of small hydro projects, Arunachal Pradesh, Nagaland, and Mizoram have undertaken some, but the potential in

²⁰ Approximately 5.5 US cents/kilowatt-hour.

²¹ Other river systems of the region, such as the Koladyne River and the Manipur River in Mizoram; the Manipur River draining into Myanmar; and the south-flowing rivers of Meghalaya and Tripura draining into Bangladesh are included in this estimate.

Arunachal (and to lesser degree in Assam, Manipur, and Sikkim) is largely unused (table 11). In recent years, Nagaland and Sikkim have initiated a few micro and pico hydel projects, where the potential for local community-level benefits could be very substantial.

Table 10. Status of major hydro development in the Northeastern Region, 2005

Potential by state	Assessed potential (at 60% load factor)	Already developed (at 60% load factor)		Under development		Developed + under development	CEA-cleared schemes (60% load factor) ^a		Developed + under development + CEA cleared ^a	
	MW	MW	%	MW	%	%	MW	%	MW	%
Arunachal	26,756	123	0.5	744	2.8	3.2	..	..	866	3.2
Assam	351	112	31.8	74	21.1	52.9	..	..	186	52.9
Manipur	1,176	72	6.1	43	3.6	9.7	..	..	114	9.7
Meghalaya	1,070	122	11.4	24	2.2	13.6	..	..	145	13.6
Mizoram	1,455	..	..	31	2.1	2.1	143	9.8	173	11.9
Nagaland	1,040	82	7.9	..	..	7.9	..	..	82	7.9
Sikkim ^b	1,283	53	4.1	121	9.4	24.1	257	20.0	430	33.5
Tripura	9	8	83.3	..	..	83.3	..	..	8	83.3
Northeastern Region	33,140	570	1.7	1,036	3.1	4.8	399	1.2	2,004	6.0
All India	84,044	15,891	18.9	4,389	5.2	24.1	3,032	3.6	23,312	27.7

.. Zero or insignificant.

a. CEA: Central Electricity Authority.

b. Sikkim has other identified projects (Teesta Stage IV, Lachen, and 16 other projects allocated to private sectors already) for a total additional installed capacity of 3,256 megawatts.

Source: compiled from statistics from the Ministry of Power, Government of India

Table 11. Status of small hydro development in the Northeastern Region (as of 1999)

State and potential	Potential	Already developed	Under development	Developed & under development	
	MW	MW	MW	MW	%
Arunachal Pradesh	342.1	21.2	20.6	41.8	12
Assam	32.5	2.2	..	2.2	7
Manipur	52.0	4.1	3.5	7.6	15
Meghalaya	22.5	1.5	0.3	1.8	8
Mizoram	42.3	5.4	8.8	14.2	33
Nagaland	8.9	3.2	5.5	8.7	97
Sikkim	..	..	..	..	..
Tripura	4.3	1.0	0.1	1.1	26
Total NE Region	504.6	38.5	38.8	77.3	15

.. Zero or insignificant.

Source: compiled from statistics provided by state governments

- 6.87 Since 2001, the Central Electricity Authority has prepared preliminary feasibility reports for 67 projects in the region (total assessed potential 31,700 megawatts) to be implemented gradually over the medium and long term. The majority of these projects are, again, located in Arunachal Pradesh (42 projects, 25,690 megawatts). However, significant projects are planned for other states also (9 projects in Meghalaya, 1,490 megawatts; 3 projects in Nagaland, 970 megawatts; 10 projects in Sikkim, 1,680 megawatts; and 3 projects in Mizoram, 1,870 megawatts). Detailed investigations of some of the projects have already started, mostly by the National Hydroelectric Power Corporation (NHPC), the National Thermal Power Corporation (NTPC), and the North Eastern Electric Power Corporation (NEEPCO). In Sikkim, 17 projects with probable installed capacity of 3,518 megawatts have already been allocated to private sector developers.

Why hydropower is important for the Northeastern Region

- 6.88 From the above it becomes clear that hydropower from the Northeastern Region is of great importance to the realization of India's development potential. And given the current socioeconomic and development status of the Northeast, which has been amply outlined above, the hydropower sector also emerges as one of the best opportunities for the Northeastern Region to benefit from the increasing national demand in order to enhance its own development. Hydropower project revenues could potentially double the region's net state domestic product.
- 6.89 As per current practices, 12 percent of the annual power generated from the projects is earmarked for the states as "free power" (which is basically a royalty paid to the states for the use of their natural resources). States have been asking for a higher share of free power in recent years, but this has been largely unsuccessful and 12 percent remains the norm. Even at 12 percent, the income (from selling the free power) that would be accrued to the states if the best hydro sites were to be developed would significantly increase the states' revenues and allow more space for revenue spending.
- 6.90 In addition to these direct financial benefits, other potential benefits include reduced flood damage in Assam if storage facilities were part of the hydropower projects in Arunachal Pradesh, and the substantial employment generated by the significant investment (~ Rs. 938 billion) for the priority projects, which in turn would have an impact on sectors such as services, transport, and tourism. Also, transport infrastructure to remote areas, built by the hydropower projects, would be of some importance to the region. Finally, benefits would include improved navigation and fisheries and considerable augmentation of lean season flows. Accordingly, hydropower may be
- "There are four deficits that confront the Northeast: a basic needs deficit; an infrastructural deficit; a resource deficit; and, most important, a two-way deficit of understanding with the rest of the country which compounds the others. The Northeast has so far depended exclusively on the Centre for development funding. A more rapid pace of the growth would generate larger internal resources...Even in the intermediate period, power generation could become the cash-strapped Northeast's largest source of resource mobilisation. Power planning and implementation of projects to tap the region's hydro/energy potential must, therefore, be seen as an essential element of national power strategy linked to plans for establishing a sub-regional or South Asian energy exchange grid." (Shukla Commission Report, 1997)

harnessed only in a few states of the Northeast, but the potential development impacts – depending on which path is chosen – could build up regionwide.

- 6.91 How much of these state-level production and revenue receipt benefits would accrue to the communities and citizens would depend on a number of factors, including governance. Equitable benefit sharing, spending the net additional revenue on purposeful community development works, would be a key challenge to the northeastern states and to the central government agencies involved (see following subsections).
- 6.92 The Northeastern Region currently has very low demand for energy (at 192 kilowatt-hours per person, one third of the national average), and even that remains unmet. Only 76 percent of the villages in the region²² have power supply, compared to the national average of 84 percent. Industrial consumption of 1,200 gigawatt-hours in the region is less than 1 percent of that of the country. With development of the hydro sector, the region would be able to attract industries with assured and cheap power supply, especially in the context of the Government of India's Look East Policy, which has included recent initiatives aimed to increase cooperation with East Asian countries, and possible international trade from the Northeastern Region (Singh 2005). One important goal would necessarily be to provide villages and communities with access to electricity (with the added benefit of improved irrigation possibilities due to greater regulation of river flow).
- 6.93 **Greenhouse gases and carbon credits.** The large hydro potential available in the Northeastern Region could make a significant contribution to reducing India's growing greenhouse gas emissions and open up possibilities for carbon trading. Currently India accounts for 4.6 percent of the world's carbon dioxide emissions, though per capita consumption of energy remains relatively low; in 2001 annual per capita consumption of electricity was 474 kilowatt-hours, compared to 1,019 for China and 12,406 for the United States. However, as per capita electricity consumption rises, carbon dioxide emissions will increase more rapidly, if more and more generation needs are serviced through thermal power.²³ Development of cleaner, renewable sources of energy in the Northeastern Region could mitigate this trend.
- 6.94 Further, hydro projects in the region could well be able to attract carbon financing. These carbon finance revenues could be used to remove some of the barriers to hydro development, such as transmission constraints, and also to cover environmental and social mitigation costs.

Major issues for development of the hydro sector in the Northeastern Region

Social and environmental considerations

- 6.95 The Northeastern Region is made up of several tribal majority states and autonomous councils, with administrative systems that differ from other areas of India and also vary

²² Nagaland and Sikkim, though, have 100 percent of villages provided with electric supply lines.

²³ According to present calculations, India will burn 450 million metric tons of coal and lignite annually for power generation by 2012.

within the region. Community involvement in decisionmaking processes related to hydropower development is essential if the benefits are to be fairly distributed. The Northeastern Region is one of the most biodiverse regions in the world, and community reliance on biodiversity resources, including forest resources, is high. Consideration of environmental conservation requirements is of local, regional, and national importance.

- 6.96 Hydropower development in the Northeastern Region may face problems of smaller scale than those experienced by similar projects elsewhere in India or other parts of the world. The estimates of land area submerged and population displaced due to hydro projects in the region are comparatively small, though challenges would still be faced in environmental management of the complex landscape and resettlement and rehabilitation of those affected, with the additional challenge of enabling communities to benefit equitably from the projects while maintaining their traditional systems.
- 6.97 For flood moderation, possible storage projects on the Dihang and Subansiri rivers were identified by the Government of India.^{24,25} These aimed to reduce the Brahmaputra flood peaks significantly, saving large areas from inundation, reducing spill retention time, and moderating erosion of the culturally important Majuli Island. The mean annual flow volumes in the Dihang and Subansiri rivers are in the order of 180,000 and 55,000 million cubic meters. Thus, the live storage of the proposed dams on these rivers amounts to about 20 percent of mean annual inflows. The Dihang live storage would amount to about 30 percent of a typical four-month monsoon flow volume from June through September.
- 6.98 Arunachal Pradesh had objected to the projects. Although the loss of forests is not considered great for Arunachal (540 square kilometers is less than 1 percent of the state's forests), the displacement of about 6 percent of the state's population, along with the drowning of the traditional homelands of smaller tribes, implies a very substantial social, political, and cultural impact. Similarly, the Tipaimukh project on the Barak (with some submergence and loss of traditional settlements of the Hmar and Zeliangrong tribes) was opposed by Manipur. In recent years, each of these storage projects has been reformulated as cascades of three or four run-of-the-river projects with limited flood cushions.²⁶

²⁴ The master plan prepared by the Brahmaputra Board proposes that the permanent solution to the perpetual problems of Assam from the annual floods in the Brahmaputra valley lies in creating storage reservoirs of adequate capacity (including the requisite allocated flood storage capacity) on the tributaries of the Brahmaputra.

²⁵ The original Siang proposal on the Siang/Dihang River envisaged a 294-meter high dam; submergence of 490 square kilometers, including 3 towns and 91 villages, and displacement of about 35,000 people; gross storage of 4.7 million ha m; and generation of 20,000 megawatt power. Arunachal objected and several other options have been developed and are under discussion between the state and central governments. The Subansiri project envisaged a 257-meter high dam; submergence of 193 square kilometers, including 1 town and 13 villages, and displacement of about 7,500 people; gross storage of 1.34 million ha m; and generation of 4,800 megawatt power.

²⁶ The 2,000 megawatt lower Subansiri project (at the site of the earlier envisaged storage project) is already under construction by the National Hydroelectric Power Corporation. There is no specific provision for flood control, but the reservoir (427 million cubic meters) could be kept at the minimum draw down level during the monsoon to provide some marginal flood moderation benefit.

- 6.99 In addition to the above, the flood moderation potential from other projects may be overlooked, as all projects in the Northeastern Region are being conceived primarily as power projects. Irrigation storage and navigation benefits may also accrue, particularly for the largest state, Assam, but possibly also for other northeastern states. The principal reason why these benefits tend to be ignored is that there is no established way of sharing the costs and the benefits of the project amongst these various uses. It is also important to recognize that there is an inherent tension in the tradeoffs between run-of-the-river schemes (which produce electricity and revenues, and reduce submergence area) and storage schemes (which produce electricity, revenues and flood moderation and irrigation for downstream states, but have a larger submergence area).
- 6.100 The Himalayan rivers have minimum flows during winter (December–February), and maximum during the monsoon (June–September). The resultant variation in power outputs from the projects, if all of these are constructed as run-of-the-river projects, would pose problems in absorbing the large block of base power during the monsoon months. Availability of regulating storage enables flexibility to suit the demand (and optimize operation of base load thermal power stations).
- 6.101 For developing storage projects, it would be important to adequately and concertedly address the critical challenges of protecting the livelihoods and the cultural and territorial identity of the tribal communities and the environment. This would imply serious examination of the tradeoffs of different development options (for example storage projects, run-of-the-river projects, or no projects) from an integrated point of view that fully takes into account the interests of the Northeastern Region and its citizens. Renewed efforts are required to ensure long-term interstate or intercommunity cooperation in the interest of larger gains based on mutually beneficial interdependencies and tradeoffs. Agreement and consent of the states and the communities would be likely to take time. Therefore, it may be prudent to study the optimal development of the potential and see if there are low-impact projects that would allow some development to take place while agreement is reached on sites with larger storage potential. This could ensure some progress while not ruling out storage sites. It would, at least, ensure that dam sites, which would bring major flood moderation benefits to the downstream poor, are not lost forever by being developed with a short-term view without exploring all possibilities of greater regional benefit.

Propensity for disasters

- 6.102 The entire region is seismically very active, and several severe earthquakes were recorded during the 20th century. Dam safety, therefore, will remain a most important consideration. Technological progress and the safety records of other hydro projects in the Himalayas suggest that earthquake considerations could be adequately incorporated. Higher safety standards would need to be adopted where necessary as an additional precaution.

Transmission

- 6.103 The Northeastern Region in itself has limited power demand. In the immediate future, until large-scale industrial expansion takes place in the region, most of the generated power will need to be transmitted to the other regions of the country. Until recently, unavailability of a power grid system in India, as well as the lack of availability of

economic and accessible sites nearer the load centers, were constraining factors for hydro sector development in the Northeastern Region. Another important factor is that, unless international transmission routes are opened, all transmission lines would need to follow the narrow Siliguri corridor through West Bengal. This means that the largest possible transmission lines will have to be built to make best use of the limited right of way.²⁷

- 6.104 India is now moving to a national power transmission grid. The capacity of interregional transmission is already 9,450 megawatts (expected to reach 16,450 megawatts in 2007, and 37,150 megawatts by 2012), which enabled energy exchange of 12 billion kilowatt-hours among the regions in 2004–2005. As part of the National Perspective Plan for Transmission, a power pooling point at Biswanath Chariyali in Assam (a 4,000 megawatt +/- 800-kilovolt high-voltage direct current bipole to Agra in the northern region) is proposed and will be completed before commissioning of the lower Subansiri project. This transmission line will be adequate to handle seasonal as well as peak or off-peak surpluses and deficits, and addition of generation capacity during the 11th Five-Year Plan. However, the cost of this line will be far greater than can be allocated only to the Subansiri project without making the delivered power cost uncompetitive. Thus there is a need to plan for transmission in the long run and find ways to minimize and defer costs until more generation comes on line. This is a significant challenge in a region in which the transmission cost is already beyond the paying capacity of the states.

Lessons from the past

- 6.105 In the past, errors and oversights occurred on some hydropower projects. It is useful to review these to ensure these are not repeated in the future. For example, the 105 megawatt Loktak project in Manipur did not pay sufficient consideration to the unique lake ecosystem and livelihood factors; the ongoing Pagladiya project did not recognize the political separation of beneficiaries and affected people. In some such cases, renegotiation and technical corrections are feasible, and should be carried out. Projects may also lose their utility, such as the project on the Gumti in Tripura (upgraded installed capacity of 15 megawatts, but outputs diminishing over the last 30 years). This project also submerged about 45,000 hectares and displaced about 9,000 tribal families. There have been suggestions to analyze if it would now make economic and political sense to decommission the dam, and resettle about 30,000 landless tribal families in the state on the rich silt-laden reservoir bed. This could make Tripura self-sufficient in grain, help ethnic reconciliation and ecological restoration, and would send a message across the region that water resource development will not take place at the cost of legitimate human and tribal interests. It is important to build this trust before large-scale projects are implemented.

²⁷ During the consultations for this study it was also mentioned that transmission lines could pass through Bhutan in order to avoid the Siliguri corridor. This would imply other issues to be resolved that would involve international negotiations. If international routes were contemplated, then routing through Bangladesh would also be a logical consideration.

Institutional arrangements for hydropower development

- 6.106 A large number of organizations (including prominent central public sector units) are involved in the power, irrigation, and flood management sectors in the Northeastern Region. The projects are within state domain, and the states are free to offer the projects to interested parties. Arunachal Pradesh has proceeded with doing just that and is now developing run-of-the-river schemes in some areas.
- 6.107 Interestingly, the semipublic and private corporations in the power sector are performing rather well and have been developing projects not only in India, but also for instance in Bhutan. This shows that with the right structure and incentives, such companies can perform effectively and efficiently.
- 6.108 However, this is with regard to stand-alone projects within a specific framework. This does not take into account the regional development dimension of investments in (hydro)power. With regard to regional coordination, responsibilities lie with the Central Electricity Authority, the Central Water Commission, the Brahmaputra Board, and the Government of India ministries. There is very little effective decentralization of the coordination arrangements to the regional or state levels, as mentioned in earlier sections, while there would be major development synergies to be brought about if a benefit-sharing perspective was applied. At this moment no such joint northeastern vision has been reached.
- 6.109 Assam and Meghalaya are the only two northeastern states that have electricity boards, the power sector in the others being departmentally managed. The two boards made losses of Rs. 3,700 million and Rs. 380 million with substantial subsidy required in 2001–2002 (compared to Rs. 160 million agricultural subsidy in Assam in that year). Overall, the power sector in the Northeast is weak and poorly run despite its tremendous potential. However, reforms have been initiated by most of the states.

Assessing the tradeoffs

- 6.110 Since hydropower offers so much revenue to the upper riparian states of the Northeast, why is there such strong resistance to these developments?
- 6.111 Despite the seismicity of the region, there is a growing consensus among engineers that the physical and engineering constraints to development of hydropower can be overcome. But it would be misleading to assume that economic problems can be resolved through engineering solutions. The removal of poverty calls for inclusive growth that creates jobs and unleashes investment, while respecting cultural and social environments. And this requires that the costs of doing business in the Northeast would need to be competitive with the rest of India. The supply of cheap electricity is clearly one important component of business costs, but there are others, including labor costs, transport costs, and investment risks related to conflict and instability. Growth requires an effort on several fronts that lower investment risks. This is not easy to achieve in a region that is geographically isolated and politically divided.
- 6.112 If attracting business to the Northeast is difficult, could the region spur development through the sale of hydropower to the rest of India? The oil-exporting countries of the Middle East produce few goods, have generally low growth rates, and yet sustain lavish lifestyles. This is an unlikely development model for the Northeast. In the Middle East,

low population densities combined with the exceptionally high rents (profits) from oil have allowed these countries to provide high living standards, without the commensurate growth and economic development. In fact, most oil- and mineral-rich countries with higher populations have performed poorly (for example Chad, Nigeria, and Venezuela), reflecting the familiar problem of the resource curse. Hence simply treating the region as a supplier of power and natural resources is unlikely to stimulate development. The thrust of the development agenda needs to be directed towards building on the region's comparative advantage, part of which includes developing its hydropower potential. However, to accelerate poverty reduction and assure inclusive and sustainable growth attention must be paid to the distribution of losses and gains, including those arising from different types of hydropower infrastructure.

- 6.113 Where do the constraints on development lie? There are two binding constraints: the first is a credibility deficit – a failure of policy promises to be matched by outcomes; and the second is an adequacy deficit – the failure to adequately compensate the losers from resource exploitation and ensure that benefits are adequately distributed.
- 6.114 Infrastructure development inevitably requires changes in land use and water entitlements and this makes the relocation of large numbers of people inevitable. The construction of dams creates winners and losers if benefits are not well distributed. This issue is highly emotive in India, which is one of the world's most prolific dam builders. Opponents highlight the asymmetry between the distribution of the benefits and the costs of dams. Dams are usually located at high elevations and may submerge scarce and declining forests that are rich in resources and where forest-dependent tribal populations reside. Benefits accrue downstream, whereas the economic and environmental costs are borne upstream. Official statistics show that tribal peoples, who comprise 8 percent of India's population, constitute 47 percent of those displaced by dams (Rangachari and others 2000). Tribal peoples tend to be poorer and economically disadvantaged, and face greater challenges in adjusting to new environments. If compensation is inadequate the development impact may be ambiguous.
- 6.115 The ascendancy of the right to develop infrastructure, over private rights, is enshrined in a Supreme Court verdict of 1994. The law, therefore, has coercive provisions (the 1894 Land Acquisition Act and its subsequent amendments) that allow for compulsory acquisition of land at prescribed rates. Simultaneously there is recognition of the need to limit the coercive powers of the state and a complex package of compensation mechanisms has evolved through a combination of executive decree and judicial activism.
- 6.116 These policies attempt to balance conflicting interests in ways that are equitable and sensitive to development priorities and attempt to address the concerns of the upper riparian states. Rudimentary calculations show that if Arunachal Pradesh, the state with the greatest hydropower potential, were to sanction all the projects identified by the central government, its revenues from the sale of free power would at least triple. But despite this clear windfall the construction of dams remains controversial. This seems paradoxical. If a project is economically beneficial to the state, why is there such widespread popular and official resistance?
- 6.117 **Credibility deficit.** With overstretched institutions and perverse incentives, implementation of the compensation packages remains uneven. There is a perception

that policy promises may not be matched by policy implementation, creating a credibility deficit. Experience has shown that nonpayment of compensation, or delays in payments and the failure to consult (as required by policy), are common. Hence, despite the virtuous intent of the policies, public confidence in the system remains low. The problem is largely one of institutional incentives. Since the official response is underpinned by the coercive provisions of the law, there is less need to generate consensus for development, nor is there a strong incentive to assure that concerns are adequately addressed in the planning and development process. The result has been an adversarial culture of mistrust. To address this calls for an unequivocal commitment to inclusiveness in planning, accountability, transparency, and openness among implementing agencies.

- 6.118 **Adequacy deficit.** There is a more damaging perception that even when compensation is paid, it is inadequate. It is difficult to judge the validity of this claim. On the one hand it represents good bargaining strategy to exaggerate the losses from relocation in the expectation that more money will be received. Case studies also show that some groups have benefited financially from the compensation schemes initiated by donor agencies. But there is also evidence that relocation has induced greater poverty and economic exclusion.
- 6.119 Regrettably there are no statistical studies that identify and quantify the magnitude or causes of impoverishment and gain. So stories of hardship play a powerful role not only in the rhetoric of opposition, but also in the genuine conviction of the losers. If impoverishment is the anticipated consequence of development, resistance will remain strident.
- 6.120 This suggests that the focus of existing policies may be misplaced and hence the solutions have been counterproductive, resulting in greater conflict, lower private investment, and greater poverty. The emphasis of current policy is largely on paying compensation for lost assets, but this does not necessarily restore and improve the earning capacity of those affected by relocation. To catalyze inclusive development, policies need to be geared towards enhancing productivity and earning potential, rather than simply compensating for losses. These problems are compounded by the form of compensation, which is typically cash. The payment of cash to vulnerable groups, with limited access to banking facilities, is equivalent to liquidating assets and thus promotes current consumption over productive saving.
- 6.121 The Northeast is not alone in facing these challenges. Similar problems arise in other parts of India and elsewhere in the world. A review of strategies shows that there are two broad approaches – those that emphasize coercion and those that seek consensus. The coercive approach used in a limited number of cases in the Northeast has not worked and has created a cycle of conflict and poverty. But there is a different path and one that provides a possible escape from this low-level equilibrium.
- 6.122 Countries facing similar problems have recognized that there is a need to develop credible mechanisms to prevent rent capture from natural resources and share some of the development benefits with losers. The strategies that have evolved reflect the institutional, legal, and political histories of the different countries. But there are common elements. The successful strategies all recognize that development will be resisted so long as losers are excluded from sharing project benefits. But in a second-best

world with weak institutions, establishing credibility and delivering meaningful benefits is difficult. In such cases alternative systems have been created to share some of the gains accruing from large projects.

- 6.123 An example of this is the development forums of Papua New Guinea. The forums are legally binding agreements between developers, the local government, and affected parties. They stipulate the rights and obligations of each party and the kinds of benefits (public goods and compensation), the responsibility for providing benefits, and the ways in which environmental impacts will be addressed. In some cases where trust is low third-party monitoring is included to assure compliance. This model has worked well and has succeeded in establishing peace in conflict-ridden regions of Papua New Guinea because it is (a) highly inclusive; (b) flexible, allowing stakeholders to choose the types of benefits that will be delivered; (c) incorporates credible oversight mechanisms with legal underpinnings; and (d) is based on voluntarism and negotiation rather than administrative decree. In other parts of India, too, similar (though less refined) approaches are being adopted. For instance, in Tamil Nadu the compensation package is based on negotiation between developers and affected parties. This allows for greater flexibility and inclusiveness in determining compensation packages.
- 6.124 Ultimately people will support development if they foresee economic benefits and if the development path is culturally and socially accepted. This requires establishing credible mechanisms to deliver on policy commitments and calls for greater inclusiveness through the sharing of benefits. Such approaches are not simply pragmatic – they lower resistance to infrastructure, but are also required to generate inclusive growth and break the vicious cycle of poverty and conflict.

Inland water transport

- 6.125 An analysis of the opportunities afforded by the Northeastern Region's water resources would not be complete without taking into account inland water transport. There is significant potential for development of inland water transport of goods and passengers in the Northeast. Little of this potential has been developed to date. This section highlights some of the various plans that have been prepared to expand the potential for inland water transport of the Brahmaputra and Barak and their tributaries, and their potential to support growth and development in the Northeast.

Existing modes of transport in the Northeastern Region

Roads

- 6.126 The main grid for transportation of goods and passengers in the Northeast is the road network of 82,000 kilometers. As shown in table 12, this network is most developed in Assam (35,000 kilometers) and Arunachal Pradesh (15,000 kilometers). The five other main states in the Northeast have networks ranging from 5,000 to 9,000 kilometers. The vast majority of roads, around 56,000 kilometers, are unpaved (*kacha*) roads, which are generally unsuitable for transportation of heavy goods.

Rail

- 6.127 The railroad network is limited to 2,500 kilometers and lies almost entirely within the state of Assam (2,466 kilometers), with short stretches in Tripura (45 kilometers) and

Arunachal Pradesh (1 kilometer). Only 961 kilometers of this network consists of standard-gauge tracks suitable for haulage of bulk goods, and the majority of the network is made up of narrow-gauge track suitable for small trains and transport of passengers and smaller cargo.

Table 12. Roads in the Northeast

State	Black topped/ graveled (km)	Dirt roads (km)	Total (km)
Arunachal Pradesh	5,550	9,400	14,950
Assam	5,534	29,595	35,129
Manipur	4,110	1,768	5,878
Meghalaya	3,110	2,514	5,624
Mizoram	1,760	3,090	4,850
Nagaland	1,984	6,708	8,656
Tripura	3,693	3,180	6,873
Total	25,705	56,255	81,960

Source: Basic Statistics of North East Region (NEC 2005).

Waterways

- 6.128 The main network of 1,800 kilometers of navigable waterways of the Brahmaputra and Barak system has been designated National Waterway 2 (NW-2), which is currently used for the transport of bulk goods, but expansion of the transportation sector is limited by the lack of transport and overhaul facilities, and natural restrictions in the river system due to sedimentation and shallow water levels. Development of the major waterways listed in table 13 could extend the transportation network for bulk goods and ferry services by 4,000 kilometers.

Table 13. Transportation potential of major waterways in the Northeast

River	Potential navigable length (km)	River	Potential navigable length (km)
Brahmaputra	891	Kapali	103
Barak	140	Kolodyne	112
Buridhing	161	Kolong	121
Dihang	129	Katakhali	161
Gangadhar	113	Paanchar	105
Subansiri	143	Others	2,012
		Total	4,191

Source: Inland Waterways Authority of India (IWAI) presentation, 2005.

- 6.129 The amount of cargo moved on NW-2 during the period 1999 to 2005 is shown in figure 8. The increase in cargo transported following 2003 was partly due to a facilitation of

transport through Bangladesh and indicates the potential of NW-2 for interregional bulk carriage. Inland waterways compete favorably with road and rail for long-distance bulk transport, and could play an important role in promoting trade in an expanding regional economy.

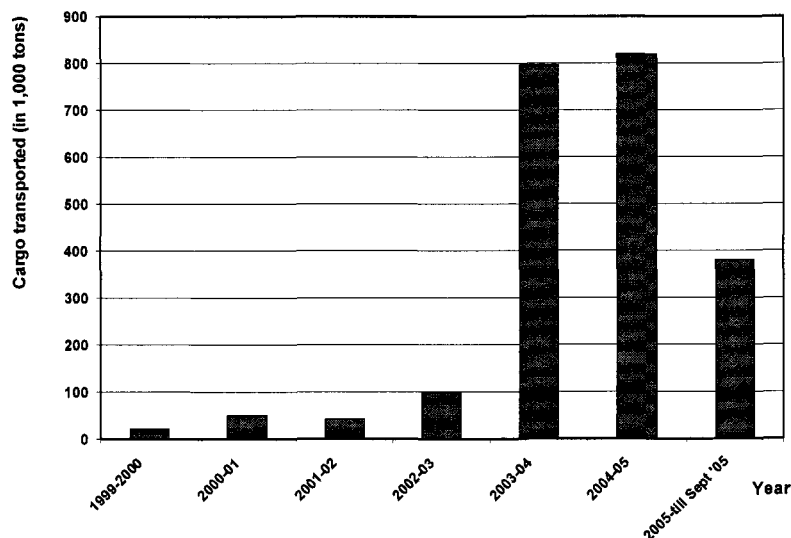


Figure 8. Cargo transported on NW-2, 1999-2005

Note: The cargo volume figures in 2002-2003 include the interdistrict and interstate cargo handled in terminals in Assam (Neamati and Dhubri). The 2004-2005 figures include the cargo handled by the Inland Water Transport Directorate in Assam and other short-haul cargo. These were not included in the earlier estimates.

Source: Inland Waterway Authority of India, 2006

Inland water transport potential in the Northeastern Region

6.130 A number of infrastructure developments have been proposed to expand the inland waterway network linked to NW-2 and improve port facilities. A 45-meter-wide canal stretch is planned for the Brahmaputra River from the Bangladesh border to Dibrugarh, 750 kilometers east, with a permanent terminal at Pandu, 24-hour navigational facilities, and floating terminals at nine locations along the canal. For the Barak River there is a proposal to construct a 40-meter-wide channel for the entire waterway, including four terminals at strategic overhaul locations. Such investments would enable the further development of several cargo routes (table 14) and ferry service routes (table 15) along NW-2.

Table 14. Major identified cargo routes on NW-2

Sl #	Identified route	Nature of cargo
1	Kolkata-Pandu	Coal, bitumen, iron, and steel
2	Pandu-Kolkata	Gypsum, tea, coal
3	Jogighopa-Kolkata	Coal (Meghalaya)
4	Tezpur-Kolkata	Tea
5	Dibrugarh-Kolkata	Tea
6	Silghat-Budge Budge	Petroleum, oil, and lubricants
7	Namrup	Urea
8	Bogaigaon refinery	RP coke

Source: Das, undated, in IWAI 2006.

Table 15. Existing ferry services on NW-2

Sl #	Route identified	Distance (km)
1	Dhubri-Phoolbari	17
2	Dhubri-Chunari	65
3	Goalpara-Ramapara	16
4	Bagbore-Guwahati-Sialmari	211
5	Sialmari-Vijaynagar-Guwahati	96
6	Bohori-Guwahati	82
7	Guwahati-N. Guwahati	4
8	Guwahati-Rajaduar	4
9	Guwahati-Karua	10
10	Kacheri-Umananda	4
11	Guwahati-Kanchanmari	80
12	Neamati-Kamalabari	12
13	Bogibil-Kerangabil	30
14	Dibrugarh-Kachari-Oriumghat	100
15	Sadiya-Saikhowa	12

Source: Inland Water Transport Directorate, Government of Assam, undated.

- 6.131 As shown in table 16, there is also a range of other waterways besides NW-2 that could be developed and contribute to the economic growth of the Northeast and promote Indo-Myanmar cross-border trade.

Table 16. Waterways not part of NW-2 with high development potential

Waterway (state)	Stretch details
Kolodyne (Mizoram)	Nengpui to Myanmar border (42 km)
Tizu (Nagaland)	Logmatar to Myanmar border (42 km)
Subansiri (Assam)	Confluence with Brahmaputra and Gerukhamukh (111 km)
Dhansiri (Assam)	Confluence with Brahmaputra and Numaligarh (26 km)
Haora (Tripura)	Bangladeshi border and Zirania (28 km)
Gumti (Tripura)	Bangladeshi border and Nutan Bazar (150 km)

Source: IWAI presentation, 2005.

- 6.132 The third major option for increased inland water transport is the further development of the international Indo-Bangladesh Protocol route for water transportation. The development of this route would increase options for goods movement to and from the Northeast and peninsular India through the Sundarbans and Bangladesh, improving the accessibility of the Northeastern Region.
- 6.133 Options for protocol routes include Kolkata to Pandu and Karimganj, Rajshahi to Dhulian, and Karimganj to Pandu. Development of these protocol routes requires a joint effort with the Government of Bangladesh to implement a set of internationally accepted protocol provisions that outline the responsibilities of both states, ensure the navigability of the waterways, and formalize the implementation procedures for appropriate infrastructure and standardization of administrative and customs regulations.

Why inland water transport is important for the Northeastern Region

- 6.134 One of the key development constraints for the Northeast over the past decades has been its geographical isolation. Certainly the advances in air flight have brought markets closer to the Northeast, but the relatively high proportion of bulky goods in the region's economy requires the further development of a means of transport suited to the movement of such goods to other regional markets – inland waterways. Specifically, the use of inland waterways as the main network for transportation of bulk goods in the Northeastern Region has a number of advantages:
- Cargo transportation to the Northeast through the Sundarbans and Bangladesh via the NW-2 waterway system and via the Meghna-Barak waterway system follows a shorter route than that taken by the rail or road network.
 - During the flood season other modes of transport are often not in operation, and inland waterways are the only viable option for transportation of goods between the Northeast and the rest of India. Basic commodities such as food grains need to be transported to the Northeast during the flood season; again, inland waterways are highly suited to such bulk transport.

- Bulk commodities and large cargo used for industrial production and large-scale construction projects can be transported through inland waterways after import and clearance at the Kolkata and Haldia ports.
- With further development of NW-2, 6 million metric tons are projected to be transported by 2020, a sevenfold increase compared to 2004.
- The projected increase in economic activity as a result of the development of inland water transport has been forecast to generate an additional 27,000 jobs by 2020, with total earnings estimated at 900,000 Rs. per day, and the overall projected rate of economic return on investments in inland water transport is around 15 percent.
- Related development and multiplier effects in the hinterlands as a result of this increased activity have not been projected, but are estimated to be significant.

Major issues for development of the inland water transport sector in the Northeastern Region

- 6.135 There are a number of issues that need to be addressed in order to initiate the sustainable development of the inland waterways in the Northeast in accordance with international best practices.

Technical

- 6.136 There are several navigational bottlenecks in the river system, where confluences and distinct meandering patterns result in increased sedimentation and shallow water levels. Cost-benefit analyses are required to evaluate which routes would offer most economic advantage in the medium to long term.

Institutional

- 6.137 At present there is not one unified body in charge of the development of inland water transport. The Inland Waterways Authority of India is responsible for the development and management of NW-2, the Inland Water Transport Directorate of the Government of Assam is responsible for the development and management of tributaries to NW-2, including the operation of passenger ferries, and in the other states waterways fall under the responsibility of either the departments of irrigation or transport. Therefore, discussions about a water resource organization in the Northeast also include integrating water transport into the overall picture.
- 6.138 Capital investment and expertise for the improvement of the waterway network requires the increased input of the private sector and the development of a structure for public-private partnerships that attracts the private sector and mitigates their financial risks. This structure would need to address the policy, institutional, and regulatory issues that need to be tackled within the framework of overall development of the waterways. It would also require an analysis of how to effectively stimulate investments in ships, ferry services, and transportation enterprises, in order to encourage private entrepreneurship to make optimal use of the upgraded waterways.

- 6.139 A key issue in making inland water transport viable for Northeastern India is increased cooperation with Bangladesh. As shown above, such cooperation has brought considerable benefits in the past five years, and there is scope for further analysis of mutually advantageous options for intercountry waterway linkages, with the ultimate goal of formalizing agreements as part of a stable trading environment in the region.
- 6.140 Transport needs to be treated in an integrated manner with the other modes of transport. Accordingly, institutions need to be set up in a way that optimizes multimodal approaches to enhancing the Northeast's transport system.

Small-scale inland water transport

- 6.141 Passengers and cargo are moved via inland water transport both in the organized sector and in the unorganized sector. In the unorganized sector, the fleet consists of wooden boats equipped with agricultural pumps. At present, there are no data regarding the transport volumes within this sector. However, this mode of transport is essential to small or remote communities for the transport of agricultural and commercial products to and from regional markets and growth centers, especially during the monsoon and flooding season. A case study (IWAI 2006, Background Paper 7) on passenger transport in and around Neamatighat showed that privately operated small-scale ferry services operated faster and more regularly than the government-operated ferry. Therefore, relatively small investments in transport facilities for private or small-scale transport services would increase the strategic connectivity of rural communities through ferry services and small goods transport. An analysis should be undertaken to identify strategic nodal points through which increased access to markets, education, or health services might bring benefits to the region.

Future role of inland water transport in the North East

- 6.142 With the renewed focus of the Government of India on the development of inland water transport and the implementation of ongoing improvement projects, it is expected that NW-2 can develop into a well-functioning waterway with adequate infrastructure within a time frame of 8 to 10 years. The development of NW-2 and of waterways in the tributary rivers would enhance the opportunities for economic growth and employment and would accelerate the development of the hinterland. Movement of such cargoes as agricultural produce, coal, limestone, petroleum, bitumen, and other basic commodities, and of materials and capital goods for hydropower projects, offers considerable growth potential.
- 6.143 Trade and commerce between India and its neighboring countries would be accelerated by the development of waterways between Nagaland and Myanmar, between Mizoram and Myanmar, and between Tripura and Bangladesh. In addition, further development of the Indo-Bangladesh Protocol routes would substantially increase trade with Bangladesh and the options for cargo movement between Kolkata and the Northeastern Region.

7. Study findings: Forests

- 7.1 This chapter presents the findings of the study with regards to forests, biodiversity, and options for carbon trading.

Forests and biodiversity in the Northeastern Region

- 7.2 The Northeastern Region can be physiographically divided into the eastern Himalayas, the northeastern hills, and the Brahmaputra and Barak valley plains. At the confluence of the Indo-Malayan and Palearctic biogeographical realms, the region contains a profusion of habitats characterized by diverse biota with a high level of endemism. The region is also the abode of approximately 135 out of India's 450 tribes, the culture and customs of which have an important role in providing lessons for biodiversity conservation.
- 7.3 The immense biodiversity of the Northeastern Region has made it a priority area for investment by the leading conservation agencies of the world. For example, the World Wide Fund for Nature (WWF) has identified the entire eastern Himalaya as a priority Global 2000 Ecoregion; and Conservation International has subsumed its eastern Himalaya "hotspot" into a wider Indo-Burma hotspot, which now includes all the eight states of the Northeast. The region is one of the endemic bird areas defined by Birdlife International, harbors a World Conservation Union (IUCN) center of endemism, and is an important subcenter for the origin of cultivated crops. The region's lowland and montane moist to wet tropical evergreen forests are considered to be the northernmost limit of true tropical rainforests in the world (Proctor, Hardasan, and Smith 1998). Northeastern India probably supports the highest bird diversity in the East, with about 836 of the 1,200 bird species known from the Indian subcontinent. The richness of the region's avifauna largely reflects the diversity of habitats associated with a wide altitudinal range. Assam hosts the entire known world population of the pygmy hog, 75 percent of the world population of the Indian rhinoceros and wild water buffalo, and a sizable population of Asian elephants and tigers.
- 7.4 Accordingly, the biodiversity of the Northeastern Region is of major importance globally and of great significance locally for citizens' livelihoods. In much of the literature about the Northeastern Region, its biodiversity is highlighted as one of its great assets and as an underlying resource for development, for example through harnessing of medicinal plants. Yet, the review undertaken for this study (WWF-India 2006, Background Paper 13) shows that there are still enormous knowledge gaps with regard not only to the biodiversity of the region, but also the potential sustainable uses of much of the flora. Despite the region's recognition as a biodiversity hotspot, biodiversity information is generally restricted to species inventories for specific locations, mainly the protected areas. Important data such as distributional patterns and population dynamics are unavailable, except for very few species. Documentation and systematic analysis of the region's biodiversity is vital to understand correlations between richness and distributional patterns, relationships between landscape variables and species composition, impacts of habitat fragmentation, and the role of biological corridors. All of these are vital for determining biodiversity management strategies and options.

- 7.5 As in the case of the water-related knowledge base, biodiversity information is scarce, and is not uniform. Arunachal Pradesh, Sikkim, Meghalaya, and Assam have more information, due possibly to a stronger institutional base, which includes the State Forest Research Institute and Northeast Regional Institute for Science and Technology and the G. B. Pant Institute for Himalayan Environment and Development in Itanagar and Gangtok, and the North East Hill University at Shillong. There is a need to develop mechanisms for generating more information in the states of Manipur, Mizoram, Nagaland, and Tripura, along the lines of such recent initiatives as the Northeastern Region Community Resource Management Project for Upland Areas (NERCRMP), a joint project under the International Fund for Agricultural Development (IFAD), the North Eastern Council, and MoDONER; the Bio Resources Development Center at Shillong; and the Nagaland environment protection and economic development (NEPED) project.²⁸ Nevertheless, there is no entity focusing on biodiversity for the entire region. In addition, the North Eastern Council recently changed the focus of the biodiversity cell at the North East Hill University from biodiversity to medicinal plants. While medicinal plants are very important in the overall picture, this shift further diminishes the options for understanding the region's biodiversity at a systemic level.
- 7.6 Both flora and fauna in the Northeastern Region are under threat due to deforestation, mining and quarrying, jhumming,²⁹ charcoal making, construction of reservoirs and dams, overharvesting of medicinal plants, drying up of wetlands, and overfishing and pollution of water bodies. In addition, conflicts between development and conservation, coupled with general political conflict in the region, are likely to have negative impacts on biodiversity conservation.
- 7.7 If the biodiversity wealth is to be maintained and developed to the benefit of the region's citizens, a number of activities in the region could be further explored (some are ongoing, as highlighted in Background Paper 13, but not as yet in a comprehensive and strategic manner). This includes assessment of capacity-building needs in the forest departments, and a focus on protected area management plans. Many protected areas do not have management plans, or their effectiveness is very limited. Besides strengthening these systems, other potentially advantageous activities include cataloguing of flora and fauna and making the information widely available, research in the use of plants, working with communities to improve their livelihoods through increases in local productivity, and collaboration between the different stakeholders.
- 7.8 There are also state biodiversity action plans, which have been developed in a participatory manner in each of the states. However, most still need to obtain the endorsement of the respective state governments for operationalization, and have not yet become part of the National Biodiversity Strategy Action Plan. While some of the plans need further strengthening, others could be implemented in phases. Sikkim is an example of a state that has formally adopted its plan and is in the process of moving towards implementation. There is also a need to provide a more adequate linkage between the state biodiversity boards and the biodiversity action plans.

²⁸ Formerly known as the Nagaland Environmental Protection and Economic Development project.

²⁹ Jhumming is not traditionally practiced in Sikkim.

- 7.9 Clearly the sustainable use and conservation of biodiversity is closely linked to the participation of the communities in the region and to the institutional and policy frameworks that govern their relationship with their natural resources. The following section provides an analysis and overview of the challenges that the region faces in sustainable forestry development.

Community forestry for sustainable development

Brief history of forestry, management, and livelihoods in the Northeastern Region

- 7.10 Forest conflicts in the hill regions of Northeastern India have a long history, dating back to intertribal disputes that have occurred periodically since the region was settled over one thousand years ago. Tribal resistance to British colonial incursions into the hills of northeast India in the early 19th century resulted in special policies enacted to allow customary systems of forest management and respect for traditional systems of governance. This policy reflected recognition by the British colonial government that the hill communities could not be centrally administered and were best allowed to function under their own governance systems. Also, the Indian Constitution recognizes the special rights of most indigenous hill communities under the Sixth Amendment to the Constitution.
- 7.11 Since independence, the Government of India has attempted to establish an integrated set of national environment and development policies, especially relating to the administration of public forestlands, yet the states of the Northeast present unique needs and problems. Perhaps nowhere is this exemplified as much as in the realm of community-based forest management. As one Indian analyst writes of national government misunderstanding of the unique historical experience and cultural realities of Mizoram: "This lack of understanding is ... visible in national policies and programs that ignore exceptional circumstances, resulting in a waste of resources to the disadvantage of the very people they are intended to benefit" (Singh 1996, p. 211).
- 7.12 Unlike much of the Indian subcontinent, where forest departments have functioned as state forest managers for over a century, in the Northeast most state forest departments have emerged since the 1970s. At least two thirds of the region's forests are officially under the legal authority of autonomous district councils, and are physically controlled and managed by rural people. Indigenous cultural institutions, such as village councils, chieftainships, and councils of elders, have generally done a good job of protecting their forest resources, based on a small, homogenous village society that supports collective needs and interests. Unfortunately, the past history and recent experiences of indigenous cultural institutions in forest management have been poorly documented and the institutions have received very little outside support from state or national governments or from international agencies.
- 7.13 While the forest-dependent communities of the Northeast may have considerable legal authority over the natural resources of the region, based on legislation passed during the British colonial era, as well as under the Indian Constitution and laws approved in the 1950s in particular, at present, indigenous community-based systems of forest conservation are threatened by the absence of formal mapping, boundary registration, and titling. Trends towards privatization, sedentarization of agriculture, and commercialization have all driven activities that foster deforestation, while community

traditions supportive of forest conservation and sustainable use have generally eroded. As Singh again notes, "The intrusion of commercial forces can only be averted by strengthening the village councils and by introducing administrative and financial incentives and disincentives to deter the exploitation of natural forests" (Singh 1996, p. 214).

- 7.14 In other parts of India, forest departments and communities have received worldwide attention for their national Joint Forest Management (JFM) strategy, a program that was enacted in June 1990, and which has allowed communities to gain new rights and responsibilities for state forestlands. The JFM approach provides communities with a share of timber and nontimber forest products from public lands in return for forest protection. Although the JFM approach needs to evolve further to realize its full potential (World Bank 2006), these policies and programs have extended new incentives for marginalized rural people in India to participate in public forestland restoration activities. However, JFM and the related policies have had limited impact in the Northeast. In peninsular India, for over a century communities have had limited access rights to public forestland, and as a consequence JFM presented new opportunities to the rural poor to gain partial control over the resources. In the Northeast, many communities have historically controlled their forest resources and continue to do so. Entering into sharing agreements with their state forest departments may decrease their authority and resources, rather than enlarge them.

Institutional arrangements for forestry management in the Northeastern Region

- 7.15 Unlike other regions of India, administrative control of forest in the Northeastern Region is predominantly by community, with much of the forest listed as "unclassified" (table 17). As in other parts of India, the state forest departments administer "reserved" and "protected" forests. The reluctance of state forest departments to consider changing the "unclassified" category to reflect community claims to much of these forests remains an ongoing source of tension. As such, their attitude does not show appreciation of the special constitutional safeguards accorded to indigenous people of the region, nor their historic claims to that land; rather it reflects an orientation that such forests are waiting to be classified as reserved or protected forests that would then place them under the management of the state forest departments.
- 7.16 The region's forests are experiencing an extensive process of forest fragmentation, degradation, and outright deforestation and forest conversion. The management of the forest has suffered in the recent past due to pressure on land, the decreasing cycle of shifting cultivation, exploitation of forest for timber, and lack of scientific management strategy. Shifting cultivation has been an important factor responsible for much of the forest being classified as "open forest", especially in states like Manipur, Mizoram, Meghalaya, and Nagaland, where much of the land designated as "unclassified" forest is part of the *jhum* or swidden pool (where shifting cultivation is practiced).³⁰

³⁰ Swidden: An area of land made cultivable by cutting or burning off the vegetative cover (Chambers English Dictionary).

Table 17. Administrative classification of forest cover in northeastern India

State	Reserved (km ²)	Protected (km ²)	Unclassified (km ²)	Total (km ²)
Arunachal Pradesh	15,300	4,200	32,000	51,500
Assam	18,100	..	8,900	27,000
Manipur	1,400	4,100	11,800	17,400
Méghalaya	700	300	8,500	9,500
Mizoram	7,100	3,600	5,200	15,900
Nagaland	300	500	7,800	8,600
Tripura	3,600	500	2,900	7,000
Total	46,600	13,200	77,100	136,900

.. Zero or insignificant.

Source: compiled from state forest statistics

- 7.17 As such, these lands are cleared and burned for cultivation every 5 to 15 years, and forest regeneration is typically halted during the young secondary forest phase, changing the landscape extensively. About 450,000 families annually cultivate 10,000 square kilometers of forests, whereas total area affected by *jhumming* (shifting cultivation) is believed to be 44,000 square kilometers (Singh 1990). Degraded secondary forests, bamboo thickets and weeds, or simply barren land dominate today's "jhumscapes" (Toky and Ramakrishnan 1981; Roy and Joshi 2002). Further, as hill farmers shift to such cash crops as ginger, pineapple, and broom grass, lands once allowed to regenerate as forests are now permanently converted to agriculture, reducing total forest cover.

Government actions to conserve northeastern forests

- 7.18 Efforts of the Government of India to establish a network of protected areas in northeast India to conserve biodiversity have had limited impact due to a failure to involve indigenous communities and local government. This top-down approach to the designation of national parks and wildlife sanctuaries has fallen far short of its goals, despite the high biodiversity value of the region. The requirement of the Supreme Court of the Government of India that autonomous district councils and forest departments prepare working plans for all forests in the region has made little headway. A major constraint to these initiatives has been a failure to interface effectively with local communities that are engaged in forest protection and management.
- 7.19 According to the *Conservation Atlas of Tropical Forests: Asia and the Pacific*, "Northeast India is one of the most crucial areas in the subcontinent for attempts to develop a comprehensive conservation network", due to its rich diversity of habitats and the significant levels of endemism that are found in a wide variety of flora and fauna (Collins, Sayer, and Whitmore 1991, p. 135). Yet by 1989 only 1 percent of the area had been designated as protected, representing four national parks and three protected areas

(total area 1,880 square kilometers). Over the past 16 years, while the land formally designated as protected area has increased to 11,216 square kilometers, much of this territory remains “paper parks”, with limited functioning management on the ground. Even with these additional national parks and sanctuaries, formally designated protected areas cover less than 5 percent of the region’s territory and less than 8 percent of the Northeast’s forests. In the meantime external pressures from logging and mining activities and internal pressures for farmland and settlement continue to build, driving a process of forest degradation that threatens the rich and unique biodiversity of the region.

- 7.20 A major constraint to national efforts to designate protected areas is that many of the forests of the region, especially in the hills where biodiversity is greatest, are under the legal control of indigenous communities. As a consequence, the national government has little authority to designate land for protected areas that is not under its jurisdiction. The British colonial government and the Government of India have generally respected the customary land rights of the over 200 ethnolinguistic tribal communities residing in the Northeast, allowing these communities to retain clear authority over most of the upland forests. The demands of local communities to retain control over their natural resources are typically supported by more than 20 armed insurgency movements that reject national efforts to exert control over indigenous areas. Effective efforts to develop a conservation area network in that region will necessarily be required to involve these cultural communities as “owners” of the land, rather than following a North American model of state-sponsored and managed national parks and wildlife areas.

Community efforts to conserve forests

- 7.21 Fortunately, there is much to build upon in creating community-based protected area networks, including strong indigenous traditions of nature conservation and forest protection. Community forest management (CFM) systems have existed in diverse forms throughout the Northeastern Region for centuries and continue to be the primary mode of forest conservation and protection in that region. Community forest protection has been a key mechanism in guarding the region’s immense biodiversity.
- 7.22 As detailed in Background Paper 12 (Poffenberger and others 2006), in East Kameng District of Arunachal Pradesh the Nishi tribe has established elaborate controls over critical watersheds and forests with high natural beauty and biodiversity, including the protection of hilltop forests, forests around lakes and mountains (*sineiak*), forests in the vicinity of villages (*myoro tom*), and forests in niches and along drainages (*changtam bote*). In addition to forest protection, a variety of animals and plants are considered sacred and cannot be harmed. The Jamatia people of Killa District, Tripura, have traditions of forest conservation, but have also revitalized these strategies to restore forests that have been degraded in the past. The Nagas of Mokokchung District in Nagaland have historically divided their forests into blocks, one of which has for generations been designated as a conservation area. In recent years, they have decided to add two more blocks for conservation, as they no longer require them in their jhum land pool. In the East Khasi Hills of Meghalaya, the villagers of Mawphlang are building on 400-year-old sacred forest traditions by ordaining new forests in 18 other villages.
- 7.23 Community-based forest conservation, unfortunately, has generally received little support from government or international organizations. In the past it has not been

viewed as an important strategy for biodiversity conservation, despite its immense importance in regions like the Northeast. This is beginning to change as conservation organizations begin to understand the importance of partnering with forest-dependent peoples and including them in the decisionmaking and implementing process.

- 7.24 Nonetheless, these community-based forest management systems are under growing external pressure from national and state governments and the private sector, as well as being internally undermined by cultural change and commercialization. As traditional institutional authority is diminished, indigenous forest conservation mechanisms weaken, leading to forest fragmentation, degradation, and loss. The privatization of once communally held forests and watersheds typically leads to their deforestation and conversion to agriculture. As the landscape of the uplands of the Northeast is denuded of forest cover, much of the unique flora and fauna disappears.
- 7.25 While the Government of India is struggling to maintain the region's forest cover through the creation of national parks and protected forest areas, under the law the majority of the forests are legally held by indigenous communities, including land inside the protected areas. The need for coordination between communities, state forest departments, and the Government of India is clear, yet the reality is that in many areas mistrust and misunderstanding prevail. Without exception, current JFM programs continue to be top down, creating new institutions and bypassing indigenous CFM institutions and local government organizations. As a result, tens of millions of dollars are being invested by the Government of India under the national JFM scheme in reforestation projects that are not appropriately designed for local needs and that fail to achieve conservation objectives.

Population change

- 7.26 A major factor affecting forest cover is the growth of human populations throughout the Northeastern Region and the growing pressure that additional people place on the region's forests. While urbanization has been growing rapidly over the past few decades at a rate, in many states, of 15 to 20 percent a year, the rural population has also been expanding. As indicated in table 18, the population of most northeastern states has expanded eight to tenfold during the twentieth century. According to census statistics the population density in many states grew by approximately 30 percent between 1991 and 2001.
- 7.27 The increasing population and population density trends are reflected in the per capita availability of forestland. Between 1981 and 1995, for example, the forestland available per person has decreased by over 50 percent or more in Nagaland and Meghalaya, and by 30 percent or more in Mizoram, Manipur, and Assam. This reflects the combined impact of population growth and forestland loss. The implications are particularly important in states with high dependence on swidden farming, as the swidden rotation land pool available per capita also decreases correspondingly (table 19), often resulting in a shortened fallow period and declining sustainability of soil fertility.
- 7.28 Table 20 provides some indication of changing agricultural land productivity over time. While some states like Arunachal Pradesh, Tripura, and Nagaland show substantial gains in per capita grain production, other states, especially those heavily dependent on

swidden farming (Mizoram and Meghalaya), show declining yields per capita. This may, in part, reflect gradual losses in soil productivity due to a shortened fallow cycle.

- 7.29 The following subsection considers options in forest and landscape management for enhancing local sustainable development for a growing population.

Table 18. Population change in the Northeastern Region

State	Population density 1991 (per km ²)	Population density 2001 (per km ²)	Total population 1901	Total population 1991	Total population 2001
Arunachal Pradesh	10	13	—	864,558	1,091,117
Assam	184	320	3,289,680	22,414,322	26,638,407
Manipur	82	107	284,465	1,837,149	2,388,634
Meghalaya	79	103	340,524	1,774,778	2,306,069
Mizoram	—	—	—	689,756	891,058
Nagaland	73	120	101,550	1,209,546	1,988,636
Sikkim	—	—	59,014	406,457	540,493
Tripura	263	304	173,325	2,757,205	3,171,168

— not available.

Source: Census of India 1901, 1991, 2001.

Table 19. Per capita availability of forestland

State	1981 (ha)	1995 (ha)
Arunachal Pradesh	10.88	6.00
Assam	0.13	0.14
Manipur	1.26	0.83
Meghalaya	1.17	0.54
Mizoram	3.68	2.32
Nagaland	1.85	0.71
Tripura	0.26	0.23

Source: Datta Ray and Alam 2002, p. 8.

Table 20. Per capita grain production in northeastern states, 1972 and 1991

State	Per capita food grain production 1972 (kg)	Per capita food grain production 1991 (kg)
Arunachal Pradesh	104	253
Assam	158	154
Manipur	159	155
Meghalaya	120	87
Mizoram	244	118
Nagaland	107	160
Tripura	116	187

Source: Dutta 2002, p. 154.

Forest benefits and costs

- 7.30 Accurate, comprehensive economic data on forest production and revenues in northeast India are difficult to obtain. Since the Godavaran Decision of the Indian Supreme Court, the commercial timber sector has been substantially reduced, and while illegal logging continues in some areas, estimates on the values of trade in sawn or whole logs is hard to ascertain. The benefits and costs of forests in the Northeastern Region can be better assessed in terms of their values to local communities for fuel, nontimber forest products, domestic timber, and as a part of the agricultural system, rather than from the standpoint of industrial timber values. At the national level, supported by the Supreme Court decision, priority is being placed on managing forests to ensure environmental services, especially the hydrological function and biodiversity conservation.
- 7.31 The government has historically viewed forests and agriculture as separate entities. The linkages and interdependence of forests and agriculture in much of northeast India has seldom been recognized. As a result, forest managers regarded jhum as unsustainable land use, while agriculture extension workers and scientists may regard forests as jungle growth on agricultural land. This was at least partly because the policies were developed centrally, and senior personnel were trained for a management approach in which people were considered encroachers and outsiders. Over the years, the planners and policies have continued to separate forestry and agricultural projects. This is evident in the programs being implemented by various government line agencies.
- 7.32 For example, the National Afforestation Program of the Ministry of Environment and Forests and the National Mission on Horticulture are presently targeting jhum lands and are apportioning them for nonagricultural uses. There is a general perception among policy planners and managers that jhum is bad and needs to be eradicated. However, new thinking is developing that acknowledges that “undistorted” jhum is a viable land use, one that supports the conservation of natural resources.

- 7.33 Hill regions of northeastern India are predominantly inhabited by tribal societies whose livelihood is primarily dependent on agriculture, forest products, and limited horticulture and cash crops. Unlike the rest of India, in this region there is often no clear-cut demarcation of forest and agricultural lands. In shifting cultivation areas the same piece of land can be under agriculture at one time and under regenerating forest at another time. Some planners and managers consider this as “agriculture on forestland” while others refer to it as “forest on agricultural land”.
- 7.34 As table 21 indicates, from 1987 to 1997 nearly 13 percent of all forests were under jhum cultivation. Further, in the hill states of Manipur, Meghalaya, Mizoram, and Nagaland the proportion of forests under jhum varied from 19 to 45 percent. Other forest areas may also be a part of an older jhum cycle. It is, therefore, important to avoid a reliance on classical land use categories when attempting to understand land use patterns in swidden farming regions. Rather, it is helpful to view land use in terms of landscape-level patterns and to study and understand the changing mosaics of land use over time.

Table 21. Forest area and shifting cultivation in the Northeastern Region

State	Total forest area (km ²)	Area under jhum 1987-1997 (km ²)	% of forest area under jhum 1987-1997
Arunachal Pradesh	51,500	2,300	4.5
Assam	27,000	1,300	4.8
Manipur	17,400	3,600	20.7
Meghalaya	9,500	1,800	18.9
Mizoram	15,900	3,800	23.9
Nagaland	8,600	3,900	45.3
Tripura	7,000	600	8.6
Total northeast	136,900	17,300	12.6

Source: FSI 1999.

- 7.35 Growing population and the needs of rural communities for a better livelihood has put increasing pressure on the community lands. An increasing proportion of forestland on hill slopes is being brought into agriculture, making the soil and water systems prone to degradation. As a result a number of land use and socioeconomic changes are taking place, as described in the following paragraphs and summarized in box 5.

Box 5. Land use trends in northeast India

- Total area affected by jhum has been increasing
- Fallow period of jhum is shortening, resulting in poor forest regeneration
- Soil fertility is declining, resulting in reduced or stagnant agricultural productivity
- Availability of forest products and services is declining
- Natural resource management systems are becoming increasingly unstable
- Income from agriculture and forest is falling
- The rural poor are becoming poorer
- Community lands are being converted into private lands
- Privatization of land is leading to landlessness and social insecurity
- Jhum lands are being brought into plantation and cash crops
- Traditional community institutions are losing authority
- Government is encouraging afforestation of jhum lands
- Raising of plantation and cash crops reduces land available for subsistence food crops
- Rural poor are increasingly migrating to urban centers

- 7.36 Soil analyses before clearing and after burning in a jhum field show that the flush release of phosphorus and potash from the ashes improves the soil fertility several-fold. The fire pushes up the pH level of acidic soils, thus improving nutrient availability, destroys seeds of weeds, and controls pests. Research by a number of international agricultural research organizations demonstrates that fire allows a steady release of nitrogen throughout the cropping season (IFAD, IDRC, CIIFAD, ICRAF, and IIRR 2001). In tropical hill areas, shifting cultivation proves to be more viable and economical than any other farming system. Several studies have indicated that the output-input ratio in both monetary and energy terms is considerably higher in shifting cultivation than in settled cultivation.
- 7.37 The ratio tends to improve with the increase in duration of fallow. The difficulties emerge as the fallow period is reduced, as is taking place in the case study sites in East Kameng District, Arunachal Pradesh, and Senapati District, Manipur, as well as in many other parts of the hills. It is common for agricultural production to fall as the number of fallow years declines, as soil fertility is not able to recover. The longer duration of exposure to erosive rain also results in greater loss of topsoil. As a result, the benefits accruing from swidden decrease, while the costs to labor and materials either remain the same or increase. Communities are challenged to find ways to compensate by adding fertilizer, developing better soil and water conservation measures, and attempting to stabilize or increase the land pool to allow for a longer fallow.
- 7.38 Swidden communities are also facing a need to shift their traditional subsistence farming strategies to accommodate cash crops, such as broom grass, ginger, and pineapple, that can generate income for the households. In many hill communities farmers are planting cash crops continuously, allowing no time for a fallow period and

thereby accelerating declines in soil fertility and exacerbating erosion problems. While the benefits from an increase in household cash flow are attractive to low-income rural households, they are likely to be short-lived. The prospect is that after three to five years, these lands will no longer be able to sustain cash crops and will be abandoned, only to be occupied by aggressive shrubs and weeds such as *Mikania micarantha*, *Ageratum conyzoides*, ferns, and scrub bamboos, all of which have little domestic or commercial value. The loss of the land from the jhum pool further decreases the total available in the agricultural cycle rotation, and thereby further shortens the fallow period.

- 7.39 Given the scenario described above, many farmers, technical extension specialists, and researchers agree that agroforestry offers the best prospects for generating household income while protecting hill watersheds. In Umden, a town at 700 meters located between the cities of Guwahati (Assam) and Shillong (Meghalaya), a Khasi retired schoolteacher has been developing commercial forest gardens that produce cardamom, pepper, vanilla, and other spices and herbs.³¹ He felt the only way to prevent villagers from felling all the forest for broom grass was to find more productive uses of the forest. Other villages are also experimenting with their own agroforestry systems, but isolation from markets, lack of adequate extension and technical support, undercapitalization, forest trade regulations, and transaction costs all constrain the spread of this land use system. Wet rice farming is also being promoted in some northeastern hill communities and offers opportunities to intensify land productivity. Still, most land is not suitable for terracing and irrigation, a costly process, and even where it is possible, swidden farming systems are still required to produce other important crops.
- 7.40 In order to optimize benefits and minimize costs to production in rural parts of the Northeast, communities need to be engaged in a landscape planning process that allows them to assess their resources, explore a variety of land use options, and decide how to sustainably manage their natural resources. Once the community reaches a consensus on their land use goals and strategies it will be easier for government and international organizations to provide the necessary support.
- 7.41 In developing strategies to support a people-oriented approach to the forest sector in northeast India, it is helpful to examine needs and opportunities in a variety of major contexts. For this purpose, the region can be divided into three broad categories: lowland plains, central and eastern hill regions, and Greater Himalaya. As table 22 indicates, each region has a dramatically different system of forest tenure, per capita forestland ratio, and forestland use pattern. As a consequence, strategies for supporting more sustainable, equitable, and productive stewardship will necessarily vary.

³¹ Discussion with Dolon Malai, Umden, Ri Bhoi District, Meghalaya, December 2004.

Table 22. Major forest management contexts in northeastern India

Forest contexts (forest hectares per capita)	States, localities	Dominant forest authority	Primary forestland use	Future strategies
Lowland plains (0.14–0.23)	Assam, Tripura	Forest department Traditional institutions with little control, except in district council areas, otherwise forest management largely government driven	Mixed forests for timber production Monoculture plantations Protected areas	JFM (forest protection committees – benefit sharing, national model) Joint protection in protected areas
Central and eastern hills (0.54–2.32)	Assam hill areas, Manipur, Meghalaya, Mizoram, Nagaland	Communities Traditional, strong control and effective	Swidden/jhum land pool Nontimber forest products and domestic and local markets Sacred and watershed forests	CFM supported through JFM programs (indigenous institutions, special models)
Greater Himalaya (6.0)	Arunachal Pradesh	Forest department and communities Traditional, loose control and partially effective	Formal silviculture and traditional jhum forest gathering systems Formal and indigenous conservation	Combination of JFM and CFM strategies depending on legal status and capacity

Source: Poffenberger, et. al, 2006

Executive policies and national and international programs

- 7.42 Three program strategies that have attempted to support community-based forest management and enhance local livelihoods over the past five years have been the national government scheme under the Joint Forest Management (JFM) program; the Participatory Natural Resource Management project being funded by IFAD; and the Community Forestry Alliance for Northeast India, supported by Community Forestry International. The following discusses the strengths and weaknesses of these initiatives.

Joint Forest Management

- 7.43 Over the past five years, the Government of India has been investing tens of millions of dollars in participatory reforestation projects in Northeast India under the national Joint Forest Management (JFM) scheme. Support for community-based forestry activities is clearly needed. In a number of cases, state forest department staff are finding ways to adapt national JFM scheme resources in ways that allow them to support indigenous forms of management and priorities. Given the different characteristics between

indigenous forest management systems and state management systems, it is difficult to interface them. For example, as illustrated in table 23, the management institutions, planning and decisionmaking processes, activities, and objectives are strikingly different. Not surprisingly many JFM projects are poorly designed and fail to respond to community needs and priorities. With few exceptions, current JFM programs are top down, and create new institutions by bypassing indigenous CFM institutions, while having limited interaction with local government organizations.

Table 23. Comparison of community forest management and joint forest management systems in northeast India

Component	JFM-FDA characteristics	CFM characteristics
Management institutions	JFM committees centralized under district forest development agency (FDA)	Based on indigenous community institution with recognition from district councils
Authority structure	Top down from FDA to JFM committee	Community representatives – village meetings (dorbars, etc.)
Planning and decisionmaking	Forest department with top-down planning decisions following national JFM scheme	Consensus decisions based on local knowledge and community needs Traditional management practices
Orientation	Scheme implementation – achievement of targets Timely expenditure of annual scheme budget	Landscape-level planning – integration of forests and agriculture – long-term sustainability of use of natural resources
Regulatory system	Imposed by forest department – draws national JFM programs and state resolutions	Based on customary laws and forest use rules and regulations – ideally updated to meet contemporary land use needs
Dominant strategy	Small monoculture plantations Timber production	Natural regeneration of mixed natural forest environments producing timber, fuelwood, nontimber forest products, and a diverse range of goods
Benefit distribution	Sharing arrangement between forest department and community – market orientation	All for use within the community – primarily for subsistence needs
Activities	Implement schemes according to guidelines Achieve targets – spend budgets on schedule	Rotation and allocation of forest blocks for jhumming Protection of watershed and sacred forests Equitable distribution of forest products Resolution of disputes

Source: Poffenberger, et. al, 2006

- 7.44 The emphasis on small plantations that typifies many JFM projects fails to address the broader, landscape-level natural resource management challenges facing many northeast hill communities as they attempt to adjust to growing demographic and commercial pressures. A broad menu of technical options is needed if JFM schemes are to respond to community priorities and local perceptions of natural resource management intervention requirements.
- 7.45 A preliminary review of recent JFM orders suggests that both in scheduled and nonscheduled states of the Northeast, these implementation guidelines do not reflect the complex policy history and social context of forestry in the region. For example, a number of JFM orders issued for Sixth Schedule areas provide no linkage between district councils and the JFM committees. The powers of the forest department to revoke or cancel the individual membership of JFM committees, or dissolve a committee, raises questions regarding authority and responsibility over JFM as a means of facilitating community forestry management in the Northeast. Rights and responsibilities invested in many northeastern communities over the past century are often not reflected in new JFM orders and programs. There is a need to reassess the rights, concessions, and privileges vested with the local community. It is apparent that several historic concessions and privileges have either been revoked or have not been granted to the present forest-dependent communities in the Northeast based on the JFM orders.
- 7.46 As one forest conservator notes, based on his experience in Arunachal Pradesh, "The present approach for formulating a top-down macro plan for the village forest management committees under a forest development agency, broadly based on ocular assessments, needs to be replaced with a detailed bottom-up micro plan in consultation with and with full participation of the communities." He further notes that "The present target-based approach makes it more a forced program where sufficient time is not given to the department and the communities ... More often than not such a rigid target-driven push has resulted in failures" (Gupta 2004, p. 55).
- 7.47 The dilemma with the national JFM scheme is to find ways to access the resources so that they can be used flexibly to respond to community resource management problems and priorities. Given that this program was developed as an India-wide strategy, it was not planned to respond to the sociopolitical, legal, and cultural conditions of the Northeast. While the incentives to participate are attractive to forest-dependent peoples in much of India, given that they extend formal use rights and territorial responsibilities, by contrast northeastern hill communities are often required to share their rights with government to obtain assistance with tree planting projects.

IFAD Participatory Natural Resource Management project

- 7.48 Another strategy being introduced in northeast India is the Participatory Natural Resource Management project funded by IFAD and being implemented in Meghalaya, Manipur, and Assam. This project draws on IFAD strategies from other parts of India, including Andhra Pradesh, but appears to have somewhat greater flexibility than the JFM scheme. Several innovations that have helped this project to achieve impressive results have been the engagement of NGOs in training and extension, the reliance on the formation of microfinance self-help groups to create fiscal management capacity within the community, and the use of participatory assessment, mapping, and planning

methodologies. The challenge for the IFAD-funded initiatives is to find ways to sustain support after the project terminates.

Community Forestry Alliance for Northeast India

- 7.49 A third project is the Community Forestry Alliance for Northeast India (CFANE), which is being funded by Community Forestry International. This relatively modest initiative began with the formation of a multistakeholder working group to review the problems and opportunities confronting community resource stewardship. In 2005, the program initiated pilot activities in Meghalaya and Manipur to assist communities, forest departments, NGOs, and local government to collaborate in supporting CFM. The program is currently supporting the formation of sacred forest networks, community-district council dialogues, multistakeholder workshops, and other innovative activities that seek to create novel approaches for CFM support. Drawing on the IFAD experience, CFANE partners are supporting community-based landscape-level planning activities and the formation of self-help groups to manage community assets. In 2006–2007, the program plans to initiate an environmental service payment program with community partners for biodiversity conservation and carbon capture, though replication of these pilots will depend on other agencies.

Forest policy approaches: Conclusions

- 7.50 There is ample evidence that the Northeast's farmers are eager to improve the productivity and management of their forests and farmlands. Production systems and technologies are emerging that can respond to the dual challenges of raising income levels while ensuring sustainable natural resource use. Field-level projects are finding that it is important to address the need for resource and livelihood security. Part of this approach involves identifying rural development investments strategies that have a long-term impact on target populations and environments. IFAD has found that it is important to empower tribal women through the formation and capitalization of self-help groups and to assist them to secure rights over their assets through registration and the establishment of bank accounts.
- 7.51 Community federations can also serve a variety of supportive functions including providing training support to self-help groups, representing them with local government, rural banks, line agencies, and other organizations, addressing social issues (for example mass weddings), and resolving conflicts. Learning from Andhra Pradesh and the emerging experiences from the IFAD project clearly demonstrate that creating financial management capacity at the village level can be a strategic component of improved forest management strategies, as it builds a basis for undertaking productive enterprises. The community, rather than technical agencies or outside contractors, should manage small development projects. This empowers the community in decisionmaking (ensuring that activities reflect community needs), instills a motivation for ongoing operation and maintenance of infrastructure and assets created, and contributes to the development of capital within village funds (box 6).

Box 6. Loktak Lake catchment conservation initiative in Tokpa Kabui village

Tokpa Kabui village, in Churachandpur District in Manipur, has a population of around 500, and is involved in conservation of 1,281 hectares of the Ningthoukhong microwatershed of the 15,015 hectare Loktak Lake catchment. The community initiative (supported by a wider GEF initiative) involves both natural and added regeneration of the forestlands located in the Ningthoukhong microwatershed, and promoting alternative or supplementary livelihood options to minimize pressure on the forest resources. Community participation in this conservation initiative has already yielded visible results. It has improved the once highly degraded hill range; increased income of the village community (with annual dividends of Rs.150,000 being reinvested in restocking, women's income generation activities, and assistance to village students); reduced dependence on hunting; and has built a two-way partnership with the Loktak Development Authority. This success has promoted the idea of declaring the area a community reserve under the Wildlife (Protection) Act, and has opened up the possibility of establishing additional public infrastructure in the area. An end target of the initiative was replication of the model in nearby villages, and the model is now being replicated in the neighboring villages of Sadu, Kha-Aimol, and Ngariyan.

Source: Chawii, 2007

- 7.52 Hill communities in northeast India can also draw on experience from Southeast Asia. Sharing many of the agroclimatic features of that region, and given the growing interest of northeastern farmers in agroforestry and commercial tree crops, learning from Thailand, Indonesia, Malaysia, and other neighbors to the east has considerable relevance. For example, in Krui District in south Sumatra, community networks have developed extensive forest gardens that produce millions of dollars in resin (from the *Shorea javanica* tree) with an understorey that is a complex mix of climbers, herbs, and shrubs used for spices, medicinal materials, fruit, fiber, and other products. This system operates under customary (*adat*) laws and institutions. Krui's 50,000 hectares of community-managed agroforests also provide a buffer zone for the Bukit Barisan Selatan National Park (Poffenberger 1999, p. 75–81). Biodiversity studies show that the agroforests support much of the flora and fauna existing within the protected area, creating an expanded wildlife area.
- 7.53 CFANE has found community forest network building can help guide decisionmaking regarding strategic investments in development activities. Networks can also promote environmental service payment strategies and goals by linking community institution building, livelihoods, and natural resource projects. IFAD's experience in Andhra Pradesh demonstrates the effectiveness of direct contracting of small projects through community-based institutions.
- 7.54 Unfortunately, ongoing resource use transitions are often constrained by government policies and programs that are unsupportive, conflicting, or fail to address key needs. The private sector may also create problems by promoting land use practices that are profitable in the short term, but have negative long-term consequences. There is a need for a consistent and enabling policy framework that supports indigenous institutions, extends resource security, and provides technical and financial support in a strategic

- manner. Incentives need to be created that encourage communities to sustainably manage their forests and farmlands and allow them to gradually integrate new production activities into their ongoing resource management systems. Such strategies will need to be adapted to different contexts within the Northeast, both in terms of their legal history and status, as well as their cultural and ecological characteristics.
- 7.55 In the northeastern states of India, special community forest management policies need to be designed that reflect the historic rights and current pressures faced by rural villages. From a conservation standpoint, policies need to be developed that support community forest stewardship and create incentives for them to better withstand pressures for forest privatization and commercial exploitation. Northeastern India has been politically isolated for decades, in part due to the presence of insurgency movements in a number of states. While the central government has invested heavily in infrastructural and related development projects, they have relied on state agencies to implement them by following national strategies that may not reflect the needs and conditions of local communities. Centrally funded schemes and projects often bypass indigenous and traditional institutions, creating new project entities as activities demand. Most community-level projects that engage indigenous cultural institutions have been conducted by small NGOs with limited resources. Further, with the exception of the IFAD project that has been implementing innovative natural resource management strategies in three northeastern states since 1998, there has been little opportunity for externally aided projects.
- 7.56 Efforts to raise community resource management concerns to the national policy level have had limited impact. Most rural, indigenous communities are politically marginalized and have little voice at higher levels of national government. As a consequence, their views are poorly reflected in the formulation of national laws and policies, and they may receive little consideration in judicial decisionmaking. Without state or national policy support, or greater international understanding and financing, fragile community forest management institutions are likely to collapse under external and internal pressures, leading to an accelerated depletion of the region's rich forests and biodiversity. There is a need for mechanisms and processes that can bring government officials, forest officers, scientists, and NGOs together to explore formulating an enabling policy environment that will support local communities to act effectively as custodians of the region's forests.
- 7.57 To support community forest management in northeast India it will be necessary to revise or formulate new policies and legislation at the state and national levels that give greater formal recognition to the authority of indigenous and traditional institutions and the validity of customary resource rights and management responsibilities. Community institutions need external support to build their capacity to deal with local government (especially autonomous district councils), forest departments, NGOs, and private sector actors.
- 7.58 Forest departments need to reorient their strategies, priorities, and attitudes to relate their activities to the community managers of over 60 percent of the region's forests. This would include providing orientation for forest department staff regarding indigenous resource management institutions, traditional rules and regulations, and territorial authority. Forest departments also need to respect and support the boundaries

of community forest areas and assist in establishing communal titles to ensure that communal forestlands are conserved.

- 7.59 National programs and schemes need to adapt forestry department field programs to support indigenous community forest institutions and practices. Programs need to have the capacity to provide small grant funds to indigenous resource management institutions to hold meetings and conduct forest planning and monitoring activities. New community forestry support programs should be designed to support meetings of indigenous organizations to discuss ways to strengthen forest management. This could include forming specialized committees to operate under indigenous organization, with special responsibility for natural resource management, supported by bylaws and holding bank accounts. Community forestry rules and regulations need to be reviewed, and possibly updated, as well as being documented and registered with local government (autonomous district councils). Communities need encouragement and backstopping while developing forest management plans that consider various needs related to conservation and protected areas, water resources, production forests and their management, and agricultural production (box 7). Communities should be supported to map and demarcate community forest areas with support from the autonomous district councils and forest departments. Resulting maps should be registered with the council.

Box 7. Moving away from jhum: Iskut growers in Sihphir village, Mizoram

Though squash climber grows profusely in most parts of Mizoram, it was in Sihphir village, 18 kilometers outside Aizawl, that cultivation of this vegetable was initiated and where it gradually became a key livelihood option. The village population increased from about 70 families in 1950 to about 1,600 families in 2001. Facing difficulties associated with low productive slash-and-burn agriculture, a few entrepreneurs from the village started growing squash (or *iskut*) in 1982. Based upon the Mizo people's traditional concept of *tlawmngaihna* – a traditional code of ethics involving selfless sacrifice for the betterment of others – this initiative has reduced poverty in the area; opened up avenues for further settled cultivation, especially of commercial crops such as passion fruit; and is an encouragement to similar action in other parts of the state. In 1992, Sihphir village alone earned Rs. 4 million from squash sales, prompting four neighboring villages to adopt the model. The total income from this crop in these villages passed Rs. 10 million in 2000, with individual farmers earning as much as Rs. 400,000. Some government support has arrived in recent years in the form of Rs. 5 million worth of GI wires and about 150 community water tanks, and loans for rearing cows (to augment supplies of manure). The Iskut Growers Association, with a membership of 1,600 and headquartered in Sihphir, believes that only a fraction of the export potential has been tapped, and with additional policy and infrastructure support (such as good quality organic manure and small reservoirs), there are greater benefits to be reaped.

Source: Chawii, 2007

What next in forest management?

- 7.60 While the importance of community involvement in forest management has gained widespread acceptance in the forest sector globally, it is critically important in the Northeastern Region where the vast majority of upland forests are legally owned by rural villages. There are attractive opportunities in northeast India to create management partnerships that respect the legal authority of communities and work

through indigenous institutions drawing on centrally funded schemes as well as international conservation programs. By empowering and enabling traditional institutions and building modern management capacities within them, the forest departments will have viable partners to craft new landscape management systems that rely on networks of villages. In return, communities will be able to develop new resource management plans that address forest conservation and livelihood issues, and gain formal tenure security for their ancestral domain. Retaining ancestral domain under communal tenure may be one of the most effective strategies to maintain forest cover and protect biodiversity in a manner that respects indigenous rights to natural resources and livelihood needs. Given the demographic expansion noted above, it will be important to support community efforts to intensify land productivity, especially on sites where terracing and irrigation are possible. Agroforestry systems with a mix of commercial products including timber, fiber, spice, and medicinals would also help to generate livelihood, taking pressure off steeper slopes and allowing for longer fallow periods in jhum areas. Efforts to extend family planning and health services are also a high priority in the hills, where fertility and growth rates are often high, placing continued pressure on the resource base.

- 7.61 A further option for increased income and livelihood opportunities may present itself through the introduction of carbon financing worldwide. The following section analyzes this option in the context of the Northeastern Region.

Carbon finance opportunities for natural resources in Northeastern India

- 7.62 Carbon finance mechanisms established under the Kyoto Protocol provide financial compensation for projects that either reduce or sequester emissions of greenhouse gases. Providing a broad assessment of the carbon finance potential of the Northeastern Region at the macroeconomic level gives an idea of the scope for harnessing these funds to address the developmental and environmental needs of the region.

Why is carbon finance of interest to India and to the Northeast?

- 7.63 The sheer size of the Indian economy has made it the fifth largest emitter of greenhouse gases worldwide, though in per capita terms the country's emissions are lower than in most developed countries.³² Paradoxically this offers wide opportunities for the country to participate in the carbon trading business in ways that address both its economic and environmental needs. Carbon finance can be used to improve the efficiency and pollution intensity of production and sequester carbon through restoration of degraded forests and the establishment of new forest areas. The genesis of these opportunities lies in the concerns about climate change that culminated in the Kyoto Protocol (box 8).

³² The current gross carbon dioxide emissions per capita in India are only one sixth of the world average at 0.93 metric tons per annum.

Carbon trading mechanisms under the Kyoto Protocol

7.64 The industrialized countries that ratified the Kyoto Protocol are required to achieve a significant element of their emission reductions efforts domestically. Domestic efforts, however, can be supplemented through three international market-based mechanisms:

- Joint Implementation
- The Clean Development Mechanism (CDM)
- Emissions trading

7.65 Of these only the CDM applies to India. The CDM aims to give developing countries the option for more sustainable development by permitting industrialized countries to finance greenhouse gas reduction projects in developing countries and receive credit for doing so. As a signatory to the Kyoto Protocol and a developing country, India is not required to make any commitments to reduce greenhouse gases, but may volunteer to cooperate with the process through the CDM.

Box 8. Kyoto Protocol and greenhouse gases

On 16 February 2005, the Kyoto Protocol, an international and legally binding agreement to reduce greenhouse gas emissions worldwide, entered into force. The Kyoto Protocol stipulates actions that require industrialized countries to reduce their carbon emissions by an average of 5.2 percent below their 1990 levels in the period 2008–2012. (Source: Meijer and Damania, 2006)

Potential for carbon finance: Forest resources

7.66 As in many areas faced with increasing populations and development, forests in northeast India are under unrelenting pressure, resulting in degradation and deforestation. As pointed out in previous sections, overexploitation due to the shortening cycle of shifting cultivation is assumed to be the core driver of this forest degradation and depletion, but the contribution of other factors – illegal logging, infrastructure, and encroachment – are also important. Not only is valuable biodiversity being lost, but so too are the benefits of forest functions such as purification of water, regulation of the water flow, and the stabilization of soil erosion, in addition to climate change benefits. The CDM could provide an opportunity to secure funds to restore the region's degraded forests and establish new areas of forest cover. To access the carbon finance potential, it is useful to begin by evaluating the official forest cover statistics of northeast India.

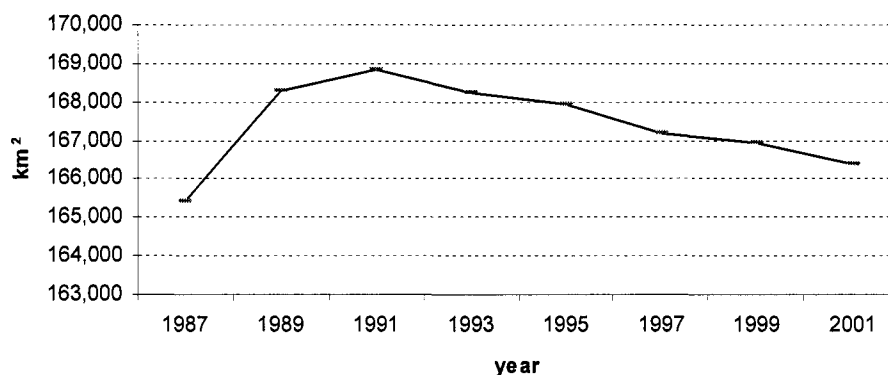
Forest cover in northeastern India

7.67 A review of the forest cover statistics of northeast India reveals some unexpected and contradictory trends. Data from the Forest Survey show an increase in forest cover between 1987 and 1991, and a steady reduction in forest cover during the 1991–2001 period (figure 9). This increase between 1987 and 1991 seems to contradict the general perception of steady forest loss during the last decades.

7.68 In addition, state-level data reveal a near 4 percent and over 5 percent increase in forest cover in Arunachal Pradesh and Sikkim, respectively, between 1987 and 1989, and an 11 percent growth rate in Tripura, amongst others (figure 10). These numbers seem implausible, since natural regeneration processes are typically considerably slower. The

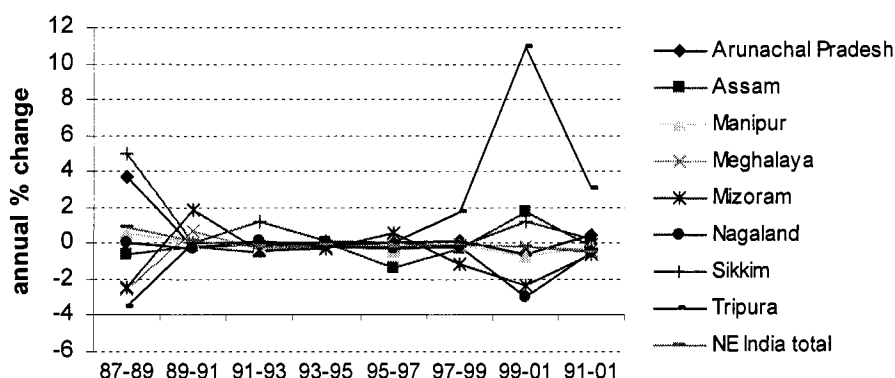
Ministry of Environment and Forests suggests that this reflects changes in data collection methodology and scale.

Figure 9. Forest cover over time, northeastern India



Source: Meijer and Damania, 2006

Figure 10. Percentage annual change in forest cover between 1987 and 2001



Source: Meijer and Damania, 2006

- 7.69 There is a popular perception that the biological potential for carbon finance in the forest sector of the Northeast is substantial. However, to qualify for CDM assistance certain conditions need to be satisfied. The principal requirement relates to the nature of land use prior to 1990. For an area to qualify for CDM funding, it must be convincingly demonstrated that it has not had forests since 1990,³³ hence the importance of representative forest statistics. This principle is stated in the following rule guiding the allocation of CDM funds: "The eligibility of land use, land use change and forestry project activities under Article 12 is limited to afforestation and reforestation."

³³ This provision was introduced to address fears that natural forests could be destroyed and CDM funds used to establish plantations of lesser biological significance.

7.70 This has major implications for the Northeastern Region. First, afforestation can only be pursued in areas that have not been forests or defined as forests for at least 50 years (box 9). Second, in order to be eligible for reforestation, areas cannot have had forests after 1990. This means that projects involving rehabilitation of forestlands that were degraded to less than 10 percent forest cover after 1990 do not qualify for funding, nor do projects that involve avoidance of deforestation. In addition, areas that have had less than 10 percent forest cover, but were officially defined as forests since 1990, are not eligible either.

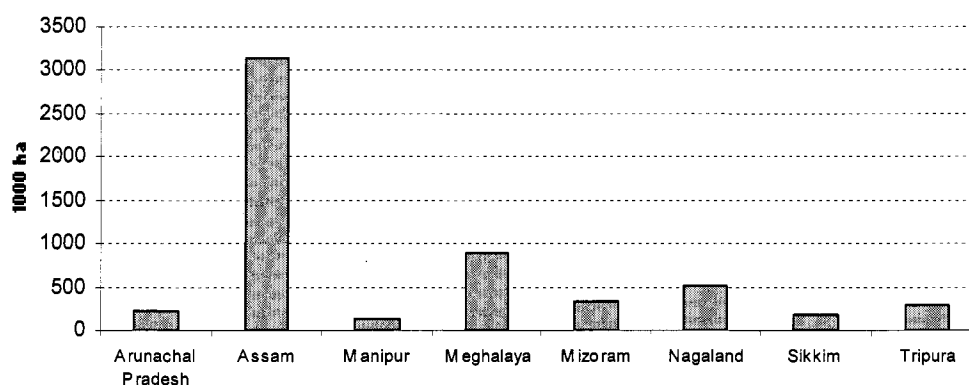
Box 9. Forest definition

A minimum area of land of 0.05–1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10–30 percent with trees with the potential to reach a minimum height of 2–5 meters at maturity in situ. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations that have yet to reach a crown density of 10–30 percent of tree height of 2–5 meters are included under forest, as are areas normally forming part of the forest area that are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest. (Source: Meijer and Damania, 2006)

7.71 It can, therefore, be concluded from these definitions that land areas that are suitable for CDM reforestation are those that are not forested or do not include degraded forests. This implies that CDM can only be used for reforestation on wastelands, farmlands, fallow land, revenue or *panchayat* or *gomal* land and other land that has not been classified as forests prior to 1990. Figure 11 shows the corresponding land areas for the states of northeast India. To guard against exaggeration the estimates are based on the lowest surface area recorded for each category between 1992 and 2002.

7.72 The potential for establishing forests in wastelands remains uncertain as many of these areas include land that is unsuitable for trees with high carbon sequestration capabilities. On the other hand, farmland is likely to be more suitable for establishing trees and would also qualify for CDM funding. Furthermore, if funding is sufficient the conversion of marginal farms to forests may provide opportunities for poor farmers to diversify into more profitable activities. The following, therefore, assesses the scope for diversifying land use on farmland using the CDM.

Figure 11. Land available for forest conversion in northeast India



Source: www.indiastat.com

Benefits and costs of agricultural land conversion

- 7.73 An analysis of the agricultural profitability of jute, paddy, and rape/mustard seed in Assam³⁴ (table 24) showed that jute provides the highest returns at US\$28 per hectare per year, followed by paddy at US\$16 per hectare per year. In the case of rape/mustard seed, the opportunity costs outweigh the benefits by US\$53, indicating that these are marginal crops grown on land with limited opportunity for diversification into higher-value commodities.
- 7.74 The financial benefits of converting agricultural land into forests will vary with the sequestration capacity of the forest and the prevailing market price of carbon. To capture this uncertainty table 25 presents the range of estimates.

Table 24. Agricultural net present benefits

Crop	Economic net benefits (US\$ per hectare per year)
Jute	27.7
Paddy	16.3
Rapeseed/mustard seed	- 53.4

(Source: Meijer and Damania, 2006)

Table 25. Forest conversion net present value

	Low carbon price	High carbon price
	(US\$ per hectare per year)	
Low sequestration	0.6	4.4
High sequestration	6.1	31.9

(Source: Meijer and Damania, 2006)

- 7.75 Looking at the net present value of forest conversion,³⁵ it was calculated that a low carbon price³⁶ and low sequestration³⁷ would just about outweigh the costs of establishing a natural forest at US\$0.6 dollar per hectare. When the low carbon price prevails, but the sequestration level is high, the benefits increase to US\$6.1 dollars per

³⁴ Only state and crops for which data were available.

³⁵ Calculated over 20 years (generally 10 to 15 years, but for forest projects 20 years is more realistic, although the benefits will go down the longer the project period as risks go up for the borrower), with an interest rate of 10 percent and costs of establishing a natural regeneration forest of US\$8 per hectare.

³⁶ US\$4 per metric ton of carbon was used as a low carbon price, and US\$10 per metric ton of carbon sequestration as a high price.

³⁷ Low sequestration was considered to be 0.5 metric ton of carbon per hectare, high sequestration 3.4 metric tons of carbon per hectare.

hectare. The high carbon price is realizing benefits under the low sequestration scenario at US\$4.4 per hectare, while the high sequestration increases them to US\$31.9.

- 7.76 The overall conclusion of this analysis appears to be that the conversion of marginal farms to forests under the high sequestration, high carbon price scenario via CDM does provide a solid potential for income generation.

Reclassification of forest areas

- 7.77 Under the current definition of forests the scope for carbon finance in the forest sector is unlikely to be large. However, the CDM recognizes the need for flexibility and allows countries to redefine land as forests so long as the definition meets certain minimum criteria (see box 9 above). This creates new opportunities for CDM to be used in areas that are currently legally classified as forests, but which in reality may include barren land or degraded forest cover. The CDM protocol simply requires that the government inform the board of its chosen definition and the mechanisms it intends to use to identify eligible areas for CDM activities. Suggested verification techniques include soil analysis, aerial and other photographic evidence, and testimonies of people living on the land.
- 7.78 For a country as large and ecologically diverse as India the biologically appropriate definition of forests should vary by ecoregion, and reflect climate, topographic, and biological characteristics of natural forests typical of the area. For the Northeast, CDM funding potential can be maximized if the definition allows for high crown density and height. Appropriate areas can be readily identified through comparative assessments of forest cover changes using the widely available aerial maps of the region. However, in the absence of an agreed definition it is impossible to quantify the financial opportunities that could emerge from the CDM. Further assessments must await government decisions.

Carbon finance funds

- 7.79 To facilitate the adaptation of carbon finance transactions in developing countries, the World Bank and GEF manage several funds that can be tapped into for finance of projects that generate carbon finance credits. These funds primarily trade on voluntary markets for emissions reductions that are not compliant with the Kyoto Protocol, for sale to corporations and individuals who want to offset their emissions for nonregulatory purposes. Emissions offset in this latter category are verified by independent verifiers, but are not certified by a regulatory authority for use as a compliance instrument, and are commonly referred to as verified emission reductions (as opposed to certified emission reductions).

Carbon finance: Conclusions

- 7.80 There are promising opportunities for carbon finance in the northeast Indian natural resource sector, despite some of the hurdles that would have to be overcome. Carbon finance opportunities for Northeast India can be taken advantage of by converting low-earning agricultural lands to forests, and by redefining currently incorrectly registered forestlands as nonforests, keeping in consideration the appropriate definitions by ecoregion.

- 7.81 Weak institutional capacity is one of the hurdles that have to be overcome when pursuing carbon finance in the forest sector. Another key factor in making carbon finance work is the level of transaction costs. When they are too high, carbon finance might not be a viable undertaking.
- 7.82 Overall, it seems that carbon finance is an opportunity for India to harness benefits for both the economy and the environment. As more projects are initiated, the generated experience and information can reduce the transaction costs. The global carbon finance mechanism itself is still in its infancy. As India is a participant in this mechanism, it will have to analyze its effectiveness in harnessing benefits for its various regions, including Northeastern India.
- 7.83 It is recommended that the focus should not be specifically on stand-alone projects, but rather on activities that complement projects dealing, for example, with land degradation, watershed issues, and biodiversity, to create greater benefit and opportunity. In this way carbon funding could generate benefits for local land users and owners as well for the local and global environment.

8. Towards an integrated vision of water resources and forests in the Northeastern Region

- 8.1 The previous chapters have shown the significant development potential in the Northeastern Region. There are huge benefits to be derived for the region as a whole from both the water-related and forest sectors. The right mix of investments in both infrastructure and in institutions – local, regional, and central – could bring benefits at the regional level, with multiplier effects throughout the region, and directly to communities at subregional and local levels.
- 8.2 The following sections will focus on answering the questions posed in chapter 4, namely:
- What are the challenges facing the region, given the current stakeholders, their incentives, and the institutional framework?
 - Which activities in the areas under study should receive priority?
 - What key institutional reforms would have to take place for priority actions to be effective and, given the political economy, what is the likelihood that they will come to pass?
 - What outcomes could be expected from the above?

Challenges facing the Northeastern Region

Consideration of the analytical framework

- 8.3 The analytical framework indicates that for a country or region to benefit from its natural resource wealth a number of institutional elements need to be present. These include clear institutional arrangements, participatory decisionmaking by the different levels of stakeholders (ranging from state governments to water users and forest-dependent producers), clear and transparent rules and regulations, and equitable enforcement of those rules and regulations. In addition, with regard to river basin management, an integrated management system would be required.
- 8.4 Very little of this exists in the Northeast today. In chapter 4, figure 3, the different elements of an institutional framework that influence stakeholders' decisionmaking were defined as (a) formal, informal, and indirect institutional arrangements; (b) instruments for natural resource management (such as forest and water use rights, and monitoring systems); and (c) the institutional management form (for example government agencies at different levels, community-based groups).
- 8.5 Based on the findings of this study, what can be said about the way in which these elements influence water and natural resource management and use in the Northeastern Region, and what are the implications for development and growth options?
- 8.6 Although this report cuts across many diverse sectors and generalizations are difficult, there seems to be a recurring pattern. The following subsections will focus on this pattern in order to highlight the needs and possible options for institutional change.

Current institutional arrangements for water and forest management in the Northeastern Region

- 8.7 As seen throughout this report, certain key themes keep emerging with regard to all sectors, notably dominance by the Centre in financing and therewith decisionmaking and very complex but at the same time incomplete institutional arrangements.
- 8.8 In the water-related sectors the formal institutional arrangements (the Constitution, the River Boards Act) give the Centre the option to exert authority over interstate waters, which it has done. The states have had limited say in these regional endeavors. The consequences seem to have been counterproductive. On the one hand a central agency can play an important role in addressing interstate tradeoffs and guiding the overall strategic objectives of water policy and development. But for this it needs a strong mandate and mission, financing and transparency in decisionmaking. Otherwise there is a risk of creating an overdependence on the Centre and eroding accountability to stakeholders.
- 8.9 In the inland water sector, some progress has been made by improving the transit protocol with Bangladesh, thus improving trade options, but border transit regulations are still hampering this way to improve the interconnectivity of the Northeast with its surroundings.
- 8.10 The states have focused on what is of most importance to them, for example flooding and erosion in Assam, irrigation in Mizoram, and lately some hydro development in Arunachal Pradesh. However, the relevant state departments have very weak capacity in terms of both human resources and finances and are heavily dependent on the Centre for financing, especially in the case of the recurring natural disasters, but also for financing of infrastructure, such as hydro or embankments for erosion mitigation. Their capacity constraints may also hamper their full participation in the Brahmaputra Board.
- 8.11 Overall, in the water-related sectors, it seems that links into community-based institutional arrangements are limited or do not exist, be it for watershed management, early warning systems, or adaptation to the recurrent floods. This goes for both state and central government initiatives.
- 8.12 These institutional arrangements also influence the **management instruments** that have been chosen and the way they are being implemented. As outlined in earlier sections, there is significant knowledge about water resources in the region, but the knowledge is still incomplete and it is partially inaccessible. Management instruments for water resources include such diverse measures as functioning river erosion monitoring systems and water allocation systems through concessions (for example for hydro or irrigation uses). Such instruments are concentrated in central government agencies and the data are not generally available to other stakeholders. In addition, the systems seem to be outdated.
- 8.13 The **organizational structures** with regard to water have then logically also become very centralized, with, for example, the Brahmaputra Board and the Central Water Commission playing the driving roles with regard to knowledge creation, archiving and use of data, and decisionmaking. There have been contradictory indications in the course of this study as to the extent to which the states, which have representatives on the Brahmaputra Board, could play a bridging role between this regional organization

and the local stakeholders. It was suggested by many during the course of this study that local stakeholders should be active participants in the organizational structures to ensure that benefits flow from these initiatives to local populations.

- 8.14 It is not surprising then that there is a lack of alignment between the articulated aim of the region's development, namely prosperity for the Northeastern Region as a whole, and the actual implementation of it. With a lack of access to data and information by the wider public, decisionmaking takes place at central levels and accordingly accountability to the public is very limited. Global experience has shown that such a situation leads to low performance and to little consideration of impacts on the ground, as indicated by the degree to which investments effectively reach beneficiaries. Stakeholders (water users, marooned flood victims, citizens without access to basic electricity in rural areas, young people without jobs) then feel abandoned and look for other sources of livelihood, for example by leaving the region or even by participating in violence.
- 8.15 The challenge then is to reverse this trend and instead build a more accountable institutional framework. This implies strong political will to counteract the tendency of a society to follow the path it has already taken due to the political or financial cost of changing it ("path dependence"). A case in point is the Brahmaputra Board: while there seems to be widespread consensus that the board has not performed and, with its current setup, is not able to deliver on its regional mandate, it is still in existence in its present form and efforts to change it (based on Prime Minister Manmohan Singh's call for a new agency for the Northeast) are impeded by long political processes.
- 8.16 Similarly, improvements in inland water transport, so important for the Northeast, are dependent on potentially lengthy negotiations with the Government of Bangladesh to establish the protocol provisions for transboundary water transport routes.
- 8.17 While this analysis now turns to the forest sector, the following two sections will return to priority actions that would help reshape the institutional framework to enable a more effective regional development path.
- 8.18 In the **forest sector**, there is a strong tendency towards Centre-led activities through the Forest Act, while more informal community customs and traditions are slowly (or rapidly?) dying out, thus diminishing options for enhancing livelihoods in the Northeast in a strategic and sustainable manner.
- 8.19 The **institutional arrangements**, as expressed for instance in the Constitution and the Forest Act, take a primarily national view, with little consideration for the special multiethnic mosaic in the Northeastern Region. As amply analyzed in chapter 7, the Joint Forest Management mechanisms are functioning well in peninsular India where tribal people who have long been marginalized are now afforded access to land and forests. In the Northeast the situation is different because much of the land is owned by tribal communities. Accordingly, the formal institutions need to be adapted to the realities of the Northeastern Region and linked into **informal institutional arrangements** by incorporating tribal customs and traditions in order to provide incentives for rural communities to more sustainably manage their forests. This would then also provide a better platform for developing sustainable ways to use the biodiversity in the Northeast for the benefit of local people and of regional development.

- 8.20 Also with regard to forests, the **resource management instruments**, including monitoring devices, cataloguing (for example of biodiversity), and definition of forest use rights, are strongly conditioned by the centralized approach defined by existing formal laws and regulations. Plans do exist, but incentives (for both government agencies and stakeholders) to apply them seem to be lacking, as very few are being implemented. The **organizational management form** for forest management in the Northeastern Region requires review in order to create functioning structures to enable forest agencies at different levels to work jointly with communities to find ways of building sustainable livelihoods.
- 8.21 Given the current institutional setup and the ensuing incentives for stakeholders, the **challenge** for the Northeastern Region is to move from a Centre-focused approach to one that gives more say to the states and to the communities within the states. The creation of structures that permit a regionwide development vision, and at the same time a vision that enables a development process at the local level, is complex. It also implies that states have to take on more responsibility for their own development.
- 8.22 Such an approach would aim to enhance cooperation across the region in order to help establish a solid basis – in terms of physical and institutional infrastructure – for joint regional action, growth, and poverty reduction. As the study findings presented in the previous chapters have shown, there are significant benefits to be derived from joint action built on a benefit-sharing vision. Action steps to implement such a vision would include strategic planning and infrastructure interventions at the macro or regional level, while simultaneously improving the lives and livelihoods of communities and citizens at the local level.

Priority activities

- 8.23 Table 26 shows, in a simplified manner, the priority activities that might address the challenges implied by the integrated approach described in the preceding section. The left-hand column designates the sector, while acknowledging that in practice there are some overlaps among sectors. The middle column shows regional-level action steps that would be considered high priority in order to create a regional enabling institutional and physical framework to enhance development activities. The third column identifies activities that can be undertaken in parallel to stimulate local development, based on the different states' needs and priorities.
- 8.24 From the sector-based analyses in this report the conclusion can be drawn that regional-level activities are a prerequisite for local-level activities if longer-lasting results are to be achieved. For instance, improved forest productivity is unlikely to contribute significantly to local development without parallel improvements in market access, through upgraded road or waterway networks, at regional level. Local community adaptation to floods will only be helpful if larger-scale flood and erosion management investments are undertaken. This is also the reason why institutional change needs to be brought about at the higher levels of natural resource management. Changes at local levels alone will not suffice to make an impact on the huge development agenda in the region.

Table 26. Priority activities at regional and local levels in the Northeast

Sector	Regional-level activities	Local-level activities
Water resources	<p>Create an appropriate institutional framework for river basin management, including an interstate river basin organization with a clear mission and mandate</p> <p>Undertake comprehensive strategic participatory river basin management and planning covering several states (Brahmaputra and Barak basins) including tradeoff analysis of different development and management options (e.g. floods, hydro, wetlands, environmental flows)</p> <p>Implement and maintain effective water monitoring systems</p> <p>Develop and support regionwide and basin-level research on water resources</p> <p>Create new or align existing state agencies for water resource management that can effectively interact with the interstate river basin organization</p>	<p>Develop groundwater resources</p> <p>Manage wetlands, restore and preserve beels</p> <p>Manage watersheds</p>
Flood and erosion management	<p>Develop and implement an operational plan to enable strategic investments in annual maintenance of flood management structures</p> <p>Carry out structural interventions to enhance erosion management</p> <p>Develop an appropriate flood and erosion monitoring system with information available to all stakeholders</p> <p>Develop a functional plan to start addressing drainage issues</p> <p>Develop a functional flood warning and community alert system</p> <p>Review and adjust existing agencies' internal incentive structures (including budget allocations and accountability structures) to enhance delivery of services</p>	<p>Enhance communities' capacities to "live intelligently with floods" through strengthening coping mechanisms, supporting and learning from innovations, improving basic health services</p> <p>Develop local capacity to link into and respond to a broader flood warning system</p> <p>Analyze local needs for watershed management to control local erosion and landslides in tributaries – "landscape management" – and work with communities to develop local watershed management actions</p>

Sector	Regional-level activities	Local-level activities
Hydropower	<p>Assess potential benefits and tradeoffs between hydropower and flood management benefits/costs and continue dialog on different options</p> <p>Develop scenarios to harness hydropower at the basin level (sequencing, integration with for example considerations for flood management benefits, inclusion of local stakeholders)</p>	<p>Develop small, mini, micro, and pico hydel projects in a more targeted manner</p> <p>Ensure benefits (for example electrification of villages, job creation) and minimize costs (for example displacement, erosion of cultural values) at local level from large hydel by developing and implementing functioning benefit-sharing mechanisms to improve people's livelihoods</p>
Inland water transport	<p>Analyze and develop opportunities for linkages between India and its neighbors in order to break Northeastern Region isolation and enhance options for trade</p> <p>Invest in multimodal transport infrastructure strategically, reinforcing the existing NW-2 to support regional connectivity with neighbors and peninsular India</p>	<p>Develop local-level infrastructure for community water transport on secondary rivers, improving access to markets and to social infrastructure (for example health, education)</p>
Forest and biodiversity management	<p>Build up a regional systematic knowledge base on biodiversity and forest resources</p> <p>Develop institutional arrangements that take into account the specific social and cultural background of the Northeastern Region</p> <p>Assess options for regional ecotourism and create an enabling institutional framework</p> <p>Carbon trading: Reclassify northeastern forests to enable carbon trading</p>	<p>Support communities in recovering and building on their traditional structures for forest management</p> <p>Develop appropriate knowledge sharing and extension service mechanisms for rural communities to develop sustainable economic activities (for example diversified agriculture, ecotourism)</p> <p>Work with local communities to find out their interest in preserving forests through carbon finance</p>

Institutional reforms and expected outcomes

8.25 What do the activities suggested in table 26 imply in institutional terms?

The case for interstate cooperation in the Northeastern Region

8.26 At the regional level, there clearly is a strong case for cooperation. This goes primarily for the water-related sectors, but also for the forest and biodiversity sectors. The huge rivers, which are the lifeblood of the region, cut across several states. Their development

and more strategic management could generate the most development impacts at the regional level, be it through reduced erosion (providing communities with assurance that investments in industries and infrastructure are sustainable), flood mitigation (saving millions of Assamese farmers from devastating effects on a recurrent basis – and with climate change possibly even more frequently than now), or through hydropower generation to the benefit of the region. Accordingly there is a need to build a vision for the Northeast that is based on development instead of stagnation and that permits an assessment of the benefits that can be derived through cooperation. For this to happen, the northeastern states need to work together in a cooperative framework, for instance within a river basin organization in which they are active and strong stakeholders and where they can negotiate with a long-term view of integrated regional development.

- 8.27 While the study has focused primarily on those parts of the Brahmaputra and Barak basins that lie within the Northeastern Region of India, it also highlights that there would be major benefits to be derived from international regional cooperation between India and its upstream and downstream neighbors. Cooperation will become all the more necessary as climate change affects the basins' hydrological regimes. Cooperation on information sharing, and joint management and development action, would benefit all basin countries by helping them to cope with increased and possibly more erratic river flows, and to harness the potential that these transboundary rivers and basins provide, for example in the area of inland water transport.

River basin management

- 8.28 The experience with the current institutional arrangements for water resource management in the Northeastern Region has shown that without active cooperation by all stakeholders, neither development nor management of the northeastern rivers is likely to happen. Possibly, a piecemeal approach has sufficed over the past decades. However, with the very real possibility of Arunachal Pradesh investing in its hydro resources and with the equally real increasing costs that Assam is experiencing due to continued flooding, there is now a need to adapt the existing institutional framework for water resource management and development to these evolving realities.
- 8.29 Modern water resource management approaches highlight the need for decentralization of decisionmaking "to the lowest appropriate levels". These appropriate levels certainly include the state governments and many decisions also need to include other stakeholders, for example communities affected by floods or erosion on tributaries.
- 8.30 The findings of the study, therefore, strongly support the plans outlined by India's prime minister to develop a new river basin management institution that would work across the entire Northeast. Its institutional features would include devolution of decisionmaking powers, with more proactive participation by the states – increasing their options to develop stronger cooperation in the Northeastern Region – and development of a comprehensive and integrated approach that would optimize the benefits from investments in flood and erosion management, hydropower, and inland water transport. Such an organization could also develop an appropriate research agenda in order to support local-level and more decentralized activities with regard to groundwater resources, wetlands, and critical watersheds.

- 8.31 A crucial ingredient in this regard would be a high level of transparency and consultation with stakeholders at all levels. This would not only enhance the decisionmaking process (because more information would enter the system), but it would also support socially beneficial outcomes. There are often large asymmetries in the assignment of benefits and costs in water- and forest-related developments. Community resistance to these projects demonstrates that there is little trust in the current system of compensation and rehabilitation and hence the water agencies routinely use coercive approaches to push through projects that are needed for development. The end result has been that decisions languish in the courts with delays and added costs to the taxpayer. The more far-reaching and significant consequence is that it perpetuates the climate of exclusion and isolation in the region. With increased transparency in the institutional arrangements (for example through public access to draft plans and data), the incentives for the new organization to perform effectively would be greatly enhanced, since it would be accountable to a wider public.
- 8.32 A further important element encouraging effective performance by river basin organizations in the long run is assured financing and support by government. Thus, the institution of a northeastern river basin organization would not imply that central government would pass all governance and financial responsibility onto the states. Rather, a cooperative approach would be adopted, with central government supporting such an organization sufficiently and predictably in order for it to carry out its designated management and development functions.
- 8.33 A distinction needs to be made between the policy-setting, planning, and regulatory functions of an interstate river basin organization and the infrastructure implementation functions of entities in the different water-related sectors. International experience in the past decades has shown that it is generally advisable to separate the construction function from the other functions since water resource organizations easily get drawn into construction only and neglect their vital management mandate. A number of countries (for example Indonesia, Brazil) have actively separated these functions into different institutions. This issue would need to be considered in the design of the new authority.
- 8.34 It is not within the scope of this study to outline the specific sector arrangements. The background documentation produced for this report shows, however, that India's power sector, for instance, already successfully distinguishes between the regulatory and power development mandates. Similarly, the inland water transport sector has its own dynamics. A river basin management framework should be appropriately crafted to tie into these sectors to enable them to function in the Northeast, but within an integrated perspective. The flood and irrigation management functions of existing state departments would need to undergo a similar analysis. It could be envisaged, for instance, that states create or upgrade their own water resource departments in order to strengthen their capacity to interact effectively with the new regional authority and also to develop and pursue those activities that they can do at state and local levels.

Flood and erosion management, hydropower, and inland water transport

- 8.35 It needs to be recognized that while the monetary benefits of hydropower make it the highest priority sector for investment, the political realities need to be taken into

account, and it will certainly take much negotiation between the interested parties to bring about interstate cooperation on this issue.

- 8.36 With regard to systemwide flood and erosion management, strategic investments at high-value priority points can certainly be identified. Incentive structures at Centre and state levels need to change in order to ensure appropriate operation and maintenance of the existing infrastructure and also a focus on strengthening communities' capacity to cope with floods, which will occur despite investments in erosion and flood management.

Forest management

- 8.37 As amply outlined in this report, the Northeastern Region boasts a vibrant tradition of community-based forest management. Current incentives seem to work against rather than for supporting this tradition. The challenge with regard to the institutional framework would thus be not only to reinforce the communities' incentives to develop or redevelop their forest management skills and to adapt them to changing demographic, social, and economic pressures, but also to change incentives so that forest departments favor community-oriented rather than centralized approaches. Such a realignment could involve, for example, changing the relevant forest classifications or adapting forest department budget allocation procedures.

Biodiversity and carbon trading

- 8.38 This report has highlighted the region's wealth of biodiversity. It has also revealed significant gaps in existing knowledge. The dream of the Northeast to use its biodiversity wealth sustainably and beneficially can only be realized if mobilization takes place at both regional and local levels, for example by fully involving local communities in regionwide efforts to catalog and document existing plants and their potential uses. Only if knowledge and awareness come together can the potential benefits be harnessed, be it through focus on medicinal plants or on developing options for ecotourism, to the benefit of the region's communities. As in the forestry sector, favorable institutional development would be stimulated by the emergence of a leader or champion, perhaps an agency or a research consortium consisting of the region's universities, to integrate biodiversity-related work.
- 8.39 With regard to carbon financing, the Centre is called upon to look at the current forest classification. Again, interstate cooperation to bring about change would be highly beneficial. The analysis shows that at this point in time the benefits that the Northeast could derive from carbon financing are far less than its natural resource base would warrant.

9. Conclusions

- 9.1 This report has shown the significant potential that exists in the Northeastern Region for its renewable natural resources to generate benefits at the regional and local levels. It has also been shown that these resources alone, without enabling institutional frameworks and an integrated vision, have not brought and will not bring development to the Northeast. The report has made an initial effort to develop such an integrated view and to show how the different sectors are linked to each other, and also how the macro and micro levels are connected.
- 9.2 With a targeted thrust that comprises central government and state stakeholders and, importantly, local communities and stakeholders, the natural resource curse does not need to become a reality in the Northeast.
- 9.3 The natural wealth of the Northeastern Region is well acknowledged. However, in the available documentation and literature, there are few suggestions on what to do in order to develop this wealth to the benefit of the region's citizens. This report has shown that for all of the topics covered in the study, institutional change is the necessary first step. Incentives need to be changed at central levels as well as at state and local levels in order to direct work towards the region's developmental goals. Key among these changes are:
- Provision of incentives to encourage interstate cooperation across the Northeastern Region
 - Devolution of decisionmaking power to appropriate lower levels by moving to a participatory approach where the various stakeholders participate more actively in the development process
 - Transparency in decisionmaking in order to increase the accountability of the different actors
- 9.4 It is always easier said than done to change institutions; such change requires the introduction of incentives, including economic incentives, supported by political will. With India moving into a new era of economic liberation encouraging free enterprise, the Northeast should not be left out. Thousands of young Northeasterners are waiting for a chance to productively contribute to their home region. Thus, with some of the changes advocated here taking place, a process would be set in motion that could support them in this endeavor. It is vital that this process includes mechanisms for equitably sharing the benefits to be derived from development and focuses not only on the big-ticket items that support broad-based, long-term growth, but also on those complementary activities that have immediate impact on poverty reduction at the community level.

Annex 1. Background Papers for the study

No.	Title	Author
1.	Water Resources in the Northeast: Development Options in a Cooperative Framework	B. G. Verghese
2.	Water Resources in the Northeast: State of the Knowledge Base	Chandan Mahanta
3.	A Fluvial Geomorphology Perspective on the Knowledge Base of the Brahmaputra	Sanjay Pahuja and Dulal Goswami
4.	River Flooding and Erosion in Northeast India	Northwest Hydraulics Consultants (lead author: Herb Wiebe)
5.	Living Intelligently with Floods	Sanjoy Hazarika
6.	Hydropower in the Northeast: Potential and Harnessing Analysis	V. V. K. Rao
7.	Perspectives of Inland Water Transport Development in the Northeast	IWAI
8.	Institutional Framework of River Basin Management in Northeast India: History, Experience and the Way Forward	M. K. Sharma
9.	Brahmaputra-Barak River Basin Organization: Legal and Constitutional Issues	Syed Naqvi
10.	Management Structures to Lead the Brahmaputra Basin into the 21 st Century	Donald Blackmore
11.	Carbon Finance and the Forest Sector in Northeast India	Siet Meijer and Richard Damania
12.	Communities and Forest Management in Northeast India	Mark Poffenberger et. al.
13.	Biodiversity Significance of Northeast India	WWF-India
14.	Natural Resource-Based Income and Livelihood Improvement Initiatives in Northeast India	Lian Chawii

Note: All background papers are available on the web at www.mdoner.gov.in and www.worldbank.org/northeastindiastudy.

Annex 2. Program for stakeholder consultations and dissemination

Draft Strategy Report and draft Background Papers					
Content and media	Intended stakeholders	Participants, contacts	Actions	Responsibility	Schedule (status)
Disseminate revised Background Papers and first draft Strategy Report through website	Wide range of stakeholders: Government of India and state governments, academia, NGOs	–	Upload revised Background Papers and draft Strategy Report onto website	MoDONER (World Bank transmits the draft and revised reports)	Mid-March 2006
Disseminate revised Background Papers and draft Strategy Report through state governments	State government departments and agencies	All NE state governments, state-level study steering committees	Letter to state governments, draft Strategy Report and revised Background Papers in CDs and hard copies to state steering committees	MoDONER, World Bank	Mid-March 2006
Invite public and stakeholder comments on revised Background Papers and draft Strategy Report	Wide range of stakeholders: academia, NGOs		Advertise documents and state-level workshops on website, invite comments	State-level steering committees, MoDONER	Mid-March 2006
Organize state-level workshops to discuss revised Background Papers and draft Strategy Report	State-based experts, NGOs, state government departments	All NE state governments, state-level study steering committees	Organize workshops, invite experts, NGOs, and relevant departments. Record feedback	State-level steering committees, MoDONER	End March to May 2006
State-level feedback: recording and reporting	–	All NE state-level study steering committees	Send state-level consolidated comments to MoDONER	All NE state governments	End March to May 2006
Consolidation of stakeholder feedback and report	–	–	Consolidated state-level comments and all other comments received through website/other	MoDONER, World Bank	May 2006

Revised Strategy Report and final Background Papers

Content and media	Intended stakeholders	Participants, contacts	Actions	Responsibility	Schedule (status)
Disseminate final Background Papers and revised Strategy Report through website	Wide range of Stakeholders: Government of India, state governments, academia, NGOs	–	Upload revised Background Papers and draft Strategy Report onto website	MoDONER (World Bank transmits the final and revised reports)	June 2006
Dissemination workshop to discuss final Background Papers and revised Strategy Report	State governments, Government of India ministries and agencies, experts	All NE state governments (departments and representatives), North Eastern Council, academic institutions, experts, NGOs	Organize workshop, invite stakeholders, disseminate presentations, record feedback	MoDONER, World Bank	End June 2006

Final Strategy Report

Content and media	Intended stakeholders	Participants, contacts	Actions	Responsibility	Schedule (status)
Prepare final Strategy Report based on feedback received in previous months	MoDONER, State Governments, MoWR, DEA	–	Prepare final Strategy Report and send to DEA for final comments	World Bank	30 June 2006
Receive comments from DEA and finalize report	DEA, MoDONER	DEA, MoDONER	Include final comments in report	DEA, World Bank, MoDONER	31 December 2006
Disseminate final Background Papers and final Strategy Report through website, disseminate in hard copies	Wide range of stakeholders: Government of India, state governments, academia, NGOs	–	Upload final Strategy Report onto website, distribute in hard copies to state governments	MoDONER (World Bank transmits final reports)	February–May 2006

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